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CONTINENTAL

VOL. 38, NO. 6 METAL FINISHING JUNE, 1940
PREPARATION, ELECTROPLATING, COATING

A New Name For An Old Servant

Time brings many changes in its wake. At its inception in 1903, this publication covered the entire field of metal working insofar as non-ferrous metals were concerned. Included in its scope was editorial matter pertaining to foundry practice, metal working, general metallurgical problems and metal finishing.

As the years passed, it became evident that the metallurgical field was growing to an extent so vast that one magazine could not hope to cover editorially both this field and that of finishing. "Metal Industry" was the only publication covering the plating and finishing industries and because of increased reader interest and the growth of this industry, our editorial matter developed more and more in this direction, and in recent years, became our major subject.

During the past ten to fifteen years, it became increasingly apparent that our name, "Metal Industry", did not fit the field which we were editorially serving. After careful deliberation, we came to the conclusion that a change in name was necessary, particularly, for the benefit of the newcomers to the industry, and to avoid the misunderstanding which has resulted from our all-inclusive name.

It is vital that the name of a publication designate specifically the subject which it covers, and therefore, the name "Metal Finishing" has been chosen to succeed "Metal Industry".

No changes are planned in regard to policy or editorial content, and we hope to continue serving faithfully the electroplating, coating and organic finishing fields.

The Organic Finishing section will be continued, to serve more specifically the field of lacquering, enameling, japanning and painting.

It is with sincere regret that this change has been found to be necessary as we are aware that the name "Metal Industry" has become well known in its service to the plating and finishing industries. However, we hope that our readers, and especially our old-time readers, will realize that the change which has been made was inevitable and is for better service.

Electropolishing

By Sam Tour

Vice President,
Lucius Pitkin, Inc.,
New York.

The author presents a discussion of the various methods available or suggested for electropolishing of metals. The theories for electropolishing and uses in metallography and industry are considered. A process involving the use of sulphuric and phosphoric acids is described. —Ed.

Perhaps one of the oldest phases of the metal finishing industry is that of polishing. The desire usually has been to present a product with a lustrous finish. In the past, each new metal adaptation has been fitted into the art of mechanical polishing. The physical and chemical properties of some of these metals have presented difficulties and required the development of new techniques and the use of more highly trained personnel. In most cases, these special techniques have added considerably to the cost of the finished product.

To cite specific examples, let us consider aluminum. Here is a metal which has been spun, cast and stamped into any number of useful forms. Yet this metal is soft and such polishing techniques as we may have used on brass or steel have not been applicable. It was necessary to vary the procedure.

Another metal which has presented difficulties, and in many shops still does, is stainless steel. Stainless steel is a metal of relatively poor thermal conductivity. It is subject to overheating in spots. To avoid its subsequent corrosion after polishing, we must not use iron polishing compounds. The application of ball burnishing to stainless steel has been very trying and difficult for the same reason. It appears that particles of iron from the balls adhere to the shapes being burnished and corrosion sets in.

Indeed, the material we polish is not the only consideration. Its shape is most important. As a matter of fact, it probably is considered good practice to design an article with as few projections, depressions, curves and recesses as possible, so that the polishing job will be simplified and made less costly.

These various physical, chemical, mechanical, and economic problems have given considerable impetus to searches for methods of doing away with or lessening mechanical polishing procedures.

The advent of bright plating, such as bright nickel, is one of the first steps towards reducing the polishing problem. Of course, this contribution is limited to cases where we are finishing the metal by plating. But what about the polishing before plating; and what of the product that is to stand alone without any special coating; the product that is to lean on its method of manufacture for its particular and decorative qualities? Until very recently, the only answer has been—polish mechanically. However, during the last three years, we have begun to see the presentation of electropolishing techniques. Perhaps, the first public demonstration of such a process, was that for stainless steel presented by Lucius Pitkin, Inc., 47 Fulton Street, New York City, in private showings in 1936 and at the Metal Products Exhibit in 1937 (see METAL INDUSTRY, August 1937, page 397).

Electropolishing as the term implies is a method of polishing metals by means of electrochemical treatment rather than by the orthodox methods of cutting, buffing, coloring, burnishing, tumbling, etc. The many-process polishing operation is reduced to but a single treatment.

Theories of Electropolishing

There have been various theories propounded to explain why we can take a metal, treat it as the anode in a particular electrolyte under certain conditions of temperature and current density, and produce a lustrous almost mirror-like finish.

One theory suggests that conditions favorable to anodic polishing result in the formation of a dense and thin film of liquid on the surface of the metal. The film is assumed to have a high electrical resistance. Projecting points on the surface receive a higher current density and are dissolved at a more rapid rate than the surrounding surface. This action results in a leveling off of the surface and the product is a polished surface.

Another theory simply suggests that on each surface there are high points and these are preferentially eaten away to cause a leveling.

Still another suggests that certain materials in the electrolyte act as inhibitors in the dissolution of the surface and the inhibitive action brings about a polished rather than etched surface.

Then, there is the theory suggested by George Hogaboom, U. S. Patent No. 1,865,470 of July 5, 1932, in explaining the action of his electrolytic bright dip for iron as being due to the anodic formation of persulphuric acid.

The reasons advanced for propounding some of these theories are logical but whether lustrous finishes are due to film formation, inhibitive action, selective dissolution, or the formation of highly oxidized products at the anode is still questionable. There has been no real proof advanced to sustain any of these theories.

Electropolishing Used in Metallography

Electropolishing is a tool sought by the metallographer as well as the metal finisher. It may be true that the metallographer applied this technique in the preparation of specimens for microscopic examination before it was introduced for commercial metal finishing. However, the electrolytes used by the metallographer, for the most part, are not the type that would be safe to make up in large tank quantities for commercial use.

For example, Pierre Jacquet, one of the outstanding pioneers in this field uses mixtures of acetic anhydride and perchloric acid in various ratios. Acetic anhydride fumes are penetrating and objectionable. Perchloric acid is a dangerous explosive. The mixing of acetic anhydride and perchloric acid is a technique in itself and not one which can be safely recommended for an industrial shop.

Nevertheless, the metallographer has been able to adopt such techniques with some success.

It has been reported by Brown (see Metal Progress, January 1940) that a specimen can be prepared for grain size determinations in 60 seconds by a method using a 60 volt rectified current and an electrolyte of one part of nitric acid to two parts of alcohol.

The principal advantages claimed have been speed and better than usual contrast and definition of constituents, inclusions and flaws.

Of course, as has been already pointed out, the techniques of the metallographer have not been of much practical advantage to the metal finisher.

Electropolishing Different from Electropickling

Aware of this new tool "electropolishing", many have probably sought out some of these processes and with the information gained are still wondering what it is all about. One question seems to be, where to draw the lines between electropickling, electrocleaning in acids, and electropolishing. They are closely related in that the electrolytes for the majority of these procedures are acids and electricity is used. However, they differ in their result and original purpose. Electropickling processes are meant for removal of scale and for etching. The etched metal surface which results is as the term describes a "pickled surface." Electrocleaning processes are meant to clean metals and are generally intended to make no material changes in the surface finish. Starting with a matte finish, they end with a matte finish.

Electropolishing differs from the other electrolytic treatments in that metal is removed from the surface and the nature of the surface is changed from its initial form to a lustrous polished form. In some cases, it is possible to start with a scaled surface and obtain a polished surface in one operation of electropolishing.

Electropolishing Processes

Recently, we have had occasion to investigate some of the processes which had been cited as possible methods for accomplishing the same results as are obtained by the Blaut-Lang process in the electropolishing of the stainless steels. These processes fell into the three categories previously mentioned.

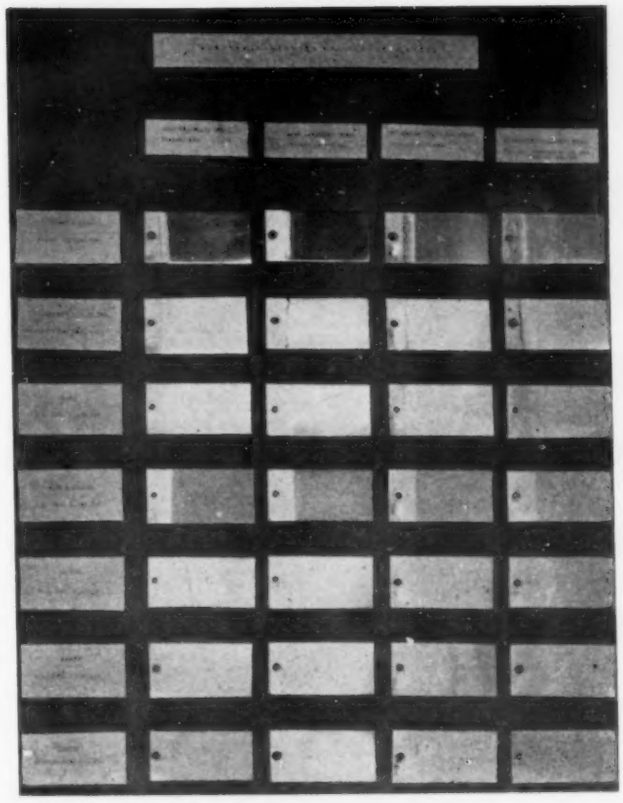

Fig. 1. Various test panels as treated by seven different processes are described on page 311.

Kelvie Process

There was the Kelvie process, U. S. Patent No. 2,037,633 of April 14, 1936, which calls for alternate anodic, still pickle, and cathodic treatments in an 18% solution of phosphoric acid as a means of removing scale. With a similar object in mind was the Marino process, British Patent No. 305,036 of April 28, 1930, which treats steel in a solution made by reacting phosphates of lime with sulphuric acid and adding sodium sulphate. The work is treated anodically and then cathodically. These two processes are meant for removing scale from steel. Thorough tests have shown that they have no polishing properties at all.

Larsen Process

The Larsen process, U. S. Patent No. 1,984,534 of Dec. 18, 1934, is a still pickle for non-ferrous metals. This process is supposed to bring about a lustrous finish by preventing tarnishing. An acid mixture consisting of 50% H_2SO_4, 36% HNO_3 and 14% H_3PO_4 is used, at room temperature. The addition of phosphoric acid is claimed to inhibit staining of the work when exposed to air on removal from the acid pickles. The inventor makes no claim for doing anything to stainless steels but calls for its use with copper alloys. Tests have shown that it does not have a polishing action on stainless steel.

Fink and Kenny

The Fink & Kenny process, U. S. Patent No. 1,961,752 of June 5, 1934, makes no claim for producing lustrous finishes. It simply calls for anodic treatment of metals in acid solutions. An example given is stainless steel in a

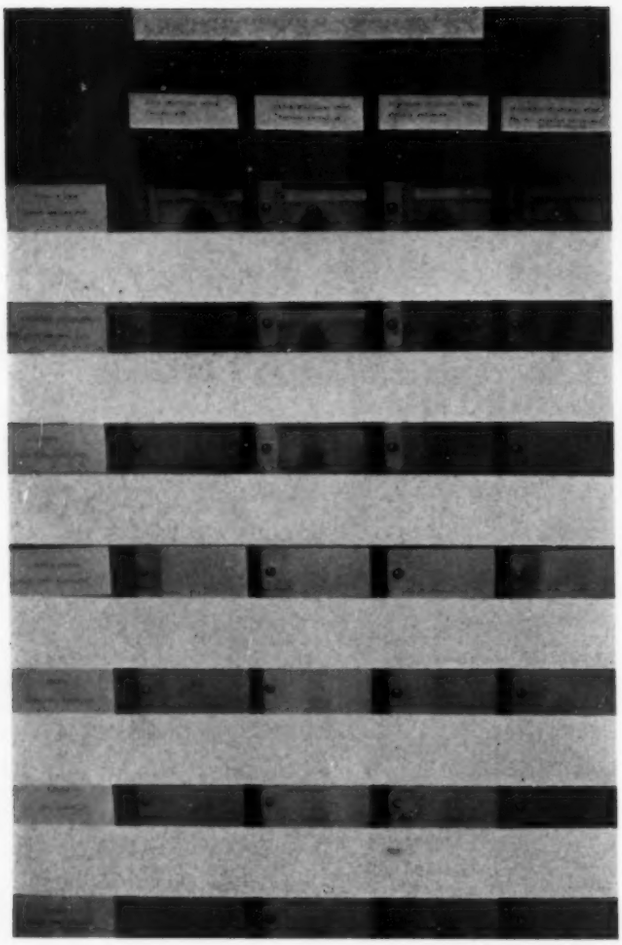

Fig. 2. Photograph of test panels to show the reflectivity of the surfaces. Good reflectivity means a good polish.

42.5% chromic acid solution at 40° C. for one hour using a current density of 0.06 amp./sq. cm. (0.39 amp./sq. in.). The result claimed is an equipotentialized surface which is much more resistant to corrosion than ordinary untreated metal. Extensive tests have shown that for electropolishing of stainless steel, this chromic acid treatment is a complete failure. In all cases, a deeply etched surface is obtained. The resulting surfaces have the appearance of over-pickling.

Burns and Warner

The Burns and Warner process, U. S. Patent No. 1,658,222 of Feb. 7, 1928, is the Western Electric patent under which the Allegheny Ludlum Steel Corp. is reported to be licensed. This process originally was an electrocleaning method. It was claimed to be particularly applicable to the electrocleaning of ferrous metals before plating. In its original version, no claim is made for polishing stainless steels. The procedure suggested is to treat the work anodically in a bath of 70% by weight of orthophosphoric acid at a temperature of 50° C. using a current density of 100 amp./sq. ft. for a time of 3 minutes.

We have treated various stainless steels as described in this patent. White pickled, No. 2B finished 18-8 stainless is very slightly affected. However, no indication of a polished lustre was obtainable. On a mechanically polished No. 4 polish 18-8 stainless steel, some electropolishing was obtainable. The treatment gave a lustre to the polish. However, on 17% chrome and 12% chrome stainless steels, the effect was definitely unfavorable. As a matter of fact, the surfaces became somewhat etched.

Kiefer Process

Samples similar to those described above were run at the conditions described in an article on the electrolytic polishing of stainless steel by George Kiefer of Allegheny Ludlum Steel Corporation, contained in the December 21, 1939 issue of The Iron Age. These differ from the original in that no particular temperature is required and the current density called for is 288 to 432 amps. per square foot. It is claimed that a luster is obtained on white pickled surfaces in 3 to 4 minutes. Samples were treated at 432 amperes per square foot for 5 minutes. The results were only slightly better than when run as the original patent described. Again, the 17 and 12% chrome stainless steels were unaffected as regards luster; on the 18-8 white pickled surface (No. 2B finish), there was a definite sign that the surface had changed but it did not appear well polished. The 18-8 polished surface (No. 4 finish) had its surface scratches much more exaggerated than previously, although the luster was better than on the original No. 4 finish.

Other Processes

Indications are that the Burns process is really limited to the 18-8 variety of stainless steel, and to be of much value the surface must have a fairly good polish to begin with.

In the manufacture of stainless steel products, the tendency is not to use polished stock as the raw material. Repolishing after manufacture is usually necessary as a result of scratches from dies and tools or the need of annealing and then pickling to remove the scale formed on annealing.

Besides the processes already described, there is that of the Rustless Iron & Steel Company which is reported to use an electrolyte of citric and sulphuric acids. We have not investigated the relative limitations or merits of this process. This can be done when more information is available as to acid concentrations.

Other people who are supposed to have processes are the Battelle Memorial Institute and the American Rolling Mill Company. They have not stated even the nature of the electrolytes which they use so no studies could be made.

The Chemical Foundation have a process which is a still chemical pickle employing titanium tetrachloride. In plants, there is a definite onus attached to the use of this material as it fumes very badly making it more than uncomfortable for the operator who must prepare the solution. Titanium tetrachloride is used for sky writing and for smoke screens. When working with this compound in any sizable quantities, a gas mask must be used.

Blaut-Lang Processes

The Blaut-Lang processes for polishing stainless steel are perhaps the first that have been offered to industry. The first electrolyte suggested is covered by U. S. Patent No. 2,115,005 of April 26, 1938 and is a solution of sulphuric and hydrofluoric acids in water. With this elec-

Effects of Various Processes on Four Types of Stainless Steel

	18-8 Stainless Steel, Finish: No. 2B.	18-8 Stainless Steel, Finish: No. 4 Polish.	17 Chrome Stainless Steel, Finish: Polished.	12 Chrome Stainless Steel, Finish: Pickled White & Rolled Smooth.
Blaut & Lang Patent Application.	Excellent polish, high luster.	Excellent polish, much higher luster than original sample.	Fair polish, better than original polish.	Fair polish.
Kiefer, Allegheny Ludlum, Iron Age, 12/21/39.	Surface attacked shows tendency to polish but no actual polish.	Polished luster not as high as Blaut Lang process.	Surface slightly etched and cleaned.	Surface cleaned.
Burns & Warner, U. S. No. 1,658,222.	Surface attacked. No polish.	Cleaning effect. Polish somewhat better than original.	Cleaning, some metal removed. The surface is dull.	Surface is cleaned. Dull pickled surface is more pronounced.
Fink & Kenny, U. S. No. 1,961,752	Deeply etched surface.	Deeply etched surface.	Deeply etched surface.	Deeply etched surface.
Kelvie, U. S. No. 2,035,633	Slight cleaning.	Slight cleaning.	Slight cleaning.	Slight cleaning.
Larsen, U. S. No. 1,984,534	Practically no effect. Slight cleaning.	Practically no effect. Slight cleaning.	Practically no effect. Slight cleaning.	Practically no effect. Slight cleaning.
Quintin Marino, British No. 305,036	Slight cleaning. Hardly any action.	Slight cleaning. Practically no effect.	Slight cleaning. Mattes the original polish.	Slight cleaning. Hardly any action.

trolyte, we are able to get a whole series of finishes ranging from matte to lustrous by simply varying the current density. Despite the advantage of this broad variety of finishes, to some the hydrofluoric acid proved a rather obnoxious component. Consequently, we have revised and improved the electrolyte so that it no longer contains hydrofluoric acid and the lustrous finish obtained is much superior and smoother.

The present electrolyte has a base of sulphuric and phosphoric acids and is the subject of patent applications now on file in the U. S. Patent Office. These acids are comparatively cheap and are available in the commercial market. The life of the bath is rather long. In one installation which has been operated continuously for the last six months, there has been no call for scrapping the bath. A very cheap addition agent has been added within the last few weeks but other than that nothing has been required.

Fig. 3. A number of etchings of 18-8 stainless steel by this original process.

The technique used is to run the bath at approximately 180° F., treating the material as the anode at a high current density. For flat stock, the current density ranges between 2 and 4 amperes per square inch. When treating wire, the current density is much higher and may be as high as 5 to 10 amperes per square inch. The times required vary with the condition of the surface, whether it is badly etched or lightly etched, or if scale is present; and what the shape of the object is, whether it be flat, curved, etc. Typical times for reasonably flat objects are 2 to 4 minutes, and for curved objects, such as spoons and bowls, 6 to 12 minutes. Voltages required are from 6 to 12.

Installation calls for lead-lined tanks, heating elements, and if the volume of electrolyte is small compared to the quantity of current being sent through, a cooling coil is generally provided. The cooling coil supplies a warm water rinse.

The cathodes are of lead or copper and are spaced as close to the work as possible.

The racks to hold the work are of copper. The ability to use copper or brass without stopoff or rubber hose coverings is peculiar to this particular process. Under the conditions of operation, copper and brass become almost completely passive. This is a very great advantage as it reduces the cost of racking and gives no worry of contact points being eaten away.

Racking of all objects is, of course, not economical. Barrels in which to treat screws, nuts, bolts, etc. are being

developed. One type used is an inclined rotating barrel submerged in the electrolyte. The work is made the anode and cathodes surround the outside of the perforated barrel.

Another type of barrel is one which lies in a horizontal position and has both inside and outside cathodes. This particular model is for continuous process operation. The former type has found success in batch operations.

Applications of Electropolishing

The applications of this process have been very wide. Though the greatest success has been outlined with 18-8 variety of stainless steel, it has been by no means limited to this one group. Some of the objects which have been treated with success and proved their adaptability are 18-8 wire, band, sheet, pressed and spun shapes and castings; 14 chrome hardened and tempered springs; 12 chrome spot welded sheets, nuts, bolts, screws, rivets, nails and surgical instruments; 24-12 cast pipe fittings; etc.

One of the greatest advantages has been the readiness and thoroughness with which apparently inaccessible recesses are penetrated. Mechanically it is almost impossible to get inside a narrow necked flask, yet these procedures make it possible without much difficulty at all. Serrated surfaces are a large order to give the polisher; yet, with electropolishing methods, they are as simple as flat surfaces, only requiring a longer time of treatment.

Of course, stainless steel is not the only metal which the metal finishers must contend with. There are nickel, Monel, Inconel, aluminum and aluminum alloys.

Nickel, Monel and Inconel can be treated with surprising success. The finishes obtained are highly polished and mirror-like. In our experience, we have found electrolytes that have great ability to penetrate into recesses. We have set up, on an experimental basis, a continuous Inconel wire polishing unit. The results were successful and point to complete simplicity for plant operation.

The Blaut-Lang process as applied to aluminum and aluminum alloys is out of its experimental stage. It has been successfully applied to chains, jelly molds, flat stock and castings. It is hoped that this treatment will prove as valuable to the aluminum metal products manufacturers as electropolishing promises to be to the stainless steel products manufacturers.

What effect electropolishing will have on the metal finishing industry as a whole is difficult to prophesy. However, it is safe to say that mechanical polishing will not be eliminated. Electropolishing has solved or is pointing the way to a solution of many problems with which the metal finisher has had difficulty. It has definitely been a solution to polishing jobs where polishing compounds or burnishing balls might cause corrosion. It has

Fig. 4. Illustration of a number of articles which have been electropolished. At the top are aluminum cake tins and two aluminum chains. Across the center are various items of 18-8 steel. Near the bottom are straight chrome chains and a straight helical chrome spring.

shown a way to get inside recesses without difficulty and to polish the insides of many objects such as pots and pans. It has shown a way to polishing metal products such as wire with much greater ease and appreciably less cost than mechanical methods. In some instances, we have found it valuable to combine both mechanical and electropolishing. It has shown a way of giving a pleasing appearance to objects such as castings which need not be smoothly polished but are made attractive by their luster. This is a field that mechanical polishing has never touched. It should somewhat relieve the industrial designer's style by giving him ample opportunity to use as many projections, angles, recessions, etc., as he may think will make a more pleasing product.

All in all, we believe that electropolishing offers the metal finisher greater dexterity in solving his polishing problems.

Lead Anodes for Chromium Plating

By Ray Eckhardt

Technical Engineer,
Acme Lead Burning Co.,
Cleveland, Ohio.

The author points out the necessity for having clean metal in making anodes. A flame technique for producing a finer crystalline structure and for closing voids present from casting is described. This procedure is said to result in a marked increase in the life of the anode.—Ed.

The selection of the correct type of lead anode for chromium plating, involves several considerations: quality of plating results obtainable; length of useful anode life; original investment, and operating cost, which in turn, involves anode shape, area of discharge surface, surface condition and electrical resistance.

Shape of Anode

For both production and job plating, the herring-bone type (Fig. 1) is widely used. It has a large discharge surface for the weight of the metal used, it can be readily cast, its original investment cost is moderate, and its electrical resistance (the voltage drop between the hook and the solution) is low.

A new type is the tubular (Fig. 2) and its modification, the semi-tubular. The former has equally low resistance in all directions and is, therefore, much used where several banks of anodes and cathodes are used,

Fig. 1. Herring-bone type anode with a large discharge surface.

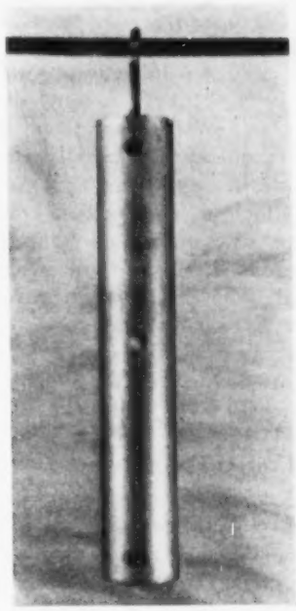

Fig. 2. Tubular type anode for chromium plating.

the tubular being placed between the cathodes. If there are anodes next to the tank sides, the semi-tubular will give equally good results at those points with a saving of lead. The plain flat or corrugated anode also has its advocates, but the present practice tends toward the herring-bone and tubular anodes already described.

Clean Metal Essential

Nothing but clean virgin metal should be used if plating troubles are to be avoided and long anode life obtained. Lead, whether pure or antimonial, is little affected by chromium solutions. Remelted scrap may contain traces of almost anything. If the percentage of impurities is fairly high, say 3%, the plating may be "off color" and the results variable. The solution, too, is likely to be afflicted with mysterious "ailments" which are hard to correct because the nature of the impurities causing them, is unknown.

A much smaller percentage, however, will materially shorten the life of the anode, because of what is known as "local action". When two dissimilar metals are in contact in a liquid which attacks only one of them, an

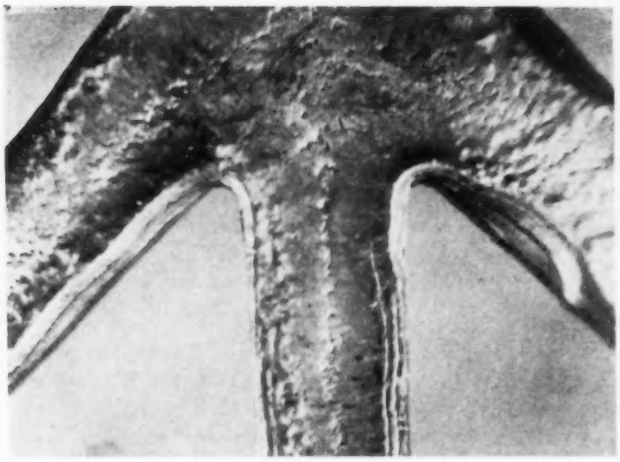

Fig. 3. Photograph of a cross-section of a plain cast anode distinctly showing porosity.

electric circuit is set up between them, and the more susceptible metal is quickly dissolved. Obviously, therefore, if for example, traces of zinc or brass in remelted scrap are adjacent to lead, pock-marks, grooves and other damage may ensue. It continues to get worse until the lead becomes a porous skeleton whose mechanical strength is negligible, and whose current-carrying capacity is greatly impaired. Eventually, the anode breaks up, but not before it has caused the plater a lot of headaches. There is no need to invite trouble by hanging an anode of unknown composition in the tank.

Crystallization vs. Flame Treating

Most anodes that are in use today are of the cast lead type. When metals are cast, there is a tendency towards large crystallization and porosity. To minimize these factors, the flame treating process was developed.

The flame treating process consists of a blow torch flame of oxygen and hydrogen played over a small section of the surface of the anode. This intense heat applied to a small surface of the metal penetrates quite deeply and the small area with which the needle-shaped flame comes in contact, is heated immediately to the melting point. The flame is then passed from this area to another, each space being heated to a melting point and the flame quickly removed. The surrounding metal and the atmosphere quickly chill these small areas that have had the flame already applied. This rapid cooling process results in a compact, fine crystalline structure. The surface of the flame treated anode distinctly shows the wave left by the flame.

Fig. 4.
Non-flame treated anode after six months of use. Notice the deep localized attack.

Fig. 5. Flame-treated lead anode after being under same service as anode in Fig. 4. Notice absence of deep attack.

The smooth and homogeneous structure greatly increases the anode's resistance to breakdown in service. Tests have proved that anodes made by this new method outlast and are more satisfactory than the cast type.

Notice the photograph (Fig. 3) of a plain cast anode, distinctly showing porosity on the cross-section of a herring-bone type anode.

Two anodes, cast in the same mold, one flame treated, the other receiving no flame treatment, were put into service at the same time in the same chromium plating tank. After six months of service (Fig. 4), one shows the action of the acid and electric current on the surface of the non-flame treated anode. Notice the grooves cut out of the metal where a spongy structure caused this effect. Also note the roughness and irregularity of the surface. This anode becomes what is known as a "tank robber", producing low quality plating and high current cost.

Fig. 5 shows the flame treated anode used under the same conditions and the same length of time, approximately six months. Observe the difference in the surface appearance of this anode. Still showing are the waves produced by the lead burning torch during the flame treating process.

Anode Construction

During recent years, a number of lead anodes having internal copper framework have been placed on the market. The principal claims made for them are: increased electrical conductivity, more evenly distributed "throwing power" and greater mechanical strength. There is a difference of opinion as to the advantages of framework construction. Personally, I do not favor it, although our plant frequently makes this type when ordered.

In conclusion, if you make up your anodes in your own shop, be sure to use only lead, the composition of which you are sure. Try the new flame treatment which will give long service. If you buy your anodes, get them from a manufacturer on whose reputation you can rely.

The Influence of Organic Compounds In Nickel Plating Solutions*

PART II

By Ernst Raub and Max Wittum

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This is the second part of the article which first appeared in the April issue of Metal Industry. In this part are considered the effects of the following substances on the standard nickel solution mentioned in Part I: Nitrogen compounds, sulfur containing compounds, proteins, aromatic acids, aromatic compounds (hydroxy compounds) and heterocyclic compounds.

In a nickel-cobalt solution produced according to American literature[4], formic acid produces a marked increase in the reflectivity of nickel-cobalt alloy deposits. (Fig. 4, Curve 7). Matte, bright coatings are produced, but 0.13 ozs./gal. (1 g/l) of formaldehyde results in a noticeable increase in brilliance (Fig. 4, Curve 8). When electrolyzed at 113°F. (45°C.), nickel has high brilliance approaching the reflectivity of buffed nickel. The cobalt content of these deposits is from 24.0 to 29.4 per cent which is not different from the concentrations in deposits from cold solutions. The effects of a few other acids, such as acetic acid, tartaric acid, citric acid and lactic acid on nickel plating, are known. Citric acid in its tertiary sodium salt form is frequently added to nickel solutions. It increases the polarization of nickel deposition and clears the bath by formation of complexes with colloidal hydroxides. Lactic acid and tartaric acid are similar to citric acid in their effects in the nickel solution.

The two keto acids, pyroracemic and levulinic acids, do not noticeably affect the properties of the nickel deposits, even when added in larger quantities, and in general, they have no effect on the brightness of the coatings.

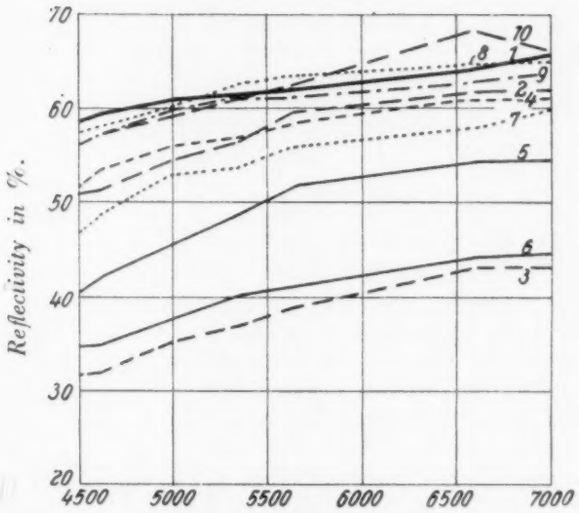
Amyl acetate acts as a good brightener in concentration of 0.013 ozs./gal. (0.1 g/l). However, the mechanical properties of the coatings are poor.

Acetoacetic ester has no distinct effect.

Nitrogen Compounds

Formamide, Urea, Methyl Urea, Uric Acid, Semi-Carbazide, Urethane, Oxamide, Glycocoll, Guanidine, Hexamethylenetetramine, Caffein

Formamide increases the brightness of nickel coatings but, however, strongly impairs their mechanical properties. A concentration of 0.067 ozs./gal. (0.5 g/l) produces non-uniform matte bright to brilliant coatings, which at lower thickness, still show good adhesion and good ductility on bending. Nickel deposits from a solution containing 0.13 ozs./gal. (1 g/l) formamide, exfoliate in the solution as soon as their thickness exceeds about 0.00016" (4μ).



Wave-lengths in A.

Fig. 4. Reflectivity of nickel deposits from solutions with additions of aliphatic compounds.

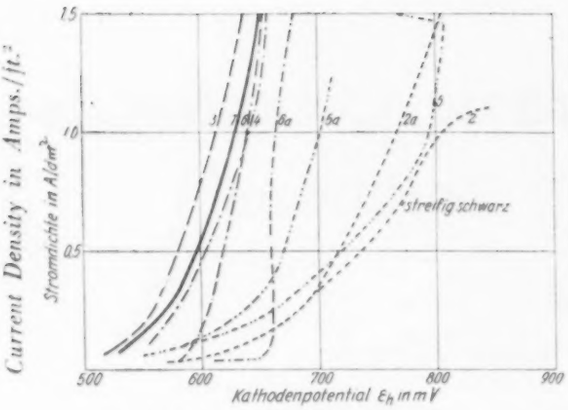
1. *Standard bath, buffed.*
2. *50 g/l glycerin, thickness of coating 6μ.*
3. *50 g/l glycerin, thickness of coating 12μ.*
4. *8 g/l formaldehyde, thickness of coating 8μ.*
5. *15 g/l dextrose, thickness of coating 5μ.*
6. *15 g/l dextrose, thickness of coating 9μ.*
7. *Ni-Co alloy bath with 35 g/l sodium formate. Thickness of coating 6μ.*
8. *Ni-Co alloy bath with 35 g/l sodium formate, plus 1 g/l formaldehyde, thickness of coating 9μ.*
9. *0.15 g/l thiourea, thickness of coating 8μ.*
10. *0.08 g/l peptone, thickness of coating 12μ.*

* Translated by Dr. Walter R. Meyer from "Der Einfluss Organischer Verbindungen auf die Galvanische Vernickelung", *Zeitschrift fuer Elektrochemie und angewandte physikalische Chemie.* Volume 46, No. 2, February (1940), pp. 71-82.

4. L. Weisberg.

Composition of Bath

Nickel sulfate	240 g/l
Nickel chloride	45 "
Sodium formate	35 "
Boric acid	30 "
Cobalt sulfate	15 "
Ammonium sulfate	2.5 "
Formaldehyde	1 "



Cathode Potential in millivolts.

Fig. 5. Influence of aliphatic compounds on the course of the cathode potential—current density curves in nickel solutions.

1. *Standard solution.*
2. *16 g/l formalin, still solution.*
2a. *16 g/l formalin, agitated solution.*
3. *20 g/l dextrose.*
4. *20 g/l sucrose.*
5. *1 g/l thiourea, still solution.*
5a. *1 g/l thiourea, agitated solution.*
6. *0.04 g/l peptone, still solution.*
6a. *0.04 g/l peptone, agitated solution.*

Urea additions increase the brightness little[5] and the polarization of nickel deposition increases. Hydrogen adheres to the surface of the cathode longer than with addition-free solutions. Urea, therefore, occasions the formation of pits especially in still baths under normal operating conditions (See Fig. 6).

Nickel deposits from solutions containing methyl urea are matte and their hardness and brittleness are greater than deposits obtained from the standard solution.

Uric acid in concentrations of 0.005 ozs./gal. (0.04 g/l), increases the brightness markedly. The adhesion of the coatings is good, but their ductility is, however, less as a result of internal tension. Thicker coatings are heavily covered with hair-like cracks. From solutions containing 0.13 ozs./gal. (1 g/l) are obtained, brilliant coatings which even exfoliate in the plating solution. In all baths containing uric acid, even at relatively low current densities, a strong evolution of hydrogen was observed which increased with an increase in current density.

Caffein, derived from uric acid, has a similar unfavorable effect on nickel deposition even additions of 0.004 ozs./gal. (0.03 g/l) disturb the nickel deposition very markedly.

Semi-carbazide, which is obtained from urea by the substitution of an NH_2 grouping by an amido group, produces in concentrations of about 0.003 ozs./gal. (0.025 g/l), a lesser improvement of the spectral reflectivity of the nickel coatings, without noticeable influence on the mechanical properties. Higher additions make the nickel again matte.

Ethyl carbamate, urethane has a similar powerful brightening effect. With additions of 0.026 ozs./gal. (0.2 g/l), brilliant nickel coatings were obtained after 30 minutes of plating, whose reflectivity, however, did not reach that of buffed nickel. Polarization is increased by urethane. The hardness of the coatings also increases, but also with an increase in brilliance.

Oxamide permits the use of only very low current densities, since it promotes a very strong evolution of hydrogen, which increases further with an increase in current density and oxamide concentration. The deposits produced at the sufficiently low current density exhibit a weak increase in reflectivity without noticeable changes in the mechanical properties. At higher current densities, however, the deposits become dark very quickly, and to some extent, spongy. Glycocoll was tested as an example of an amino acid in concentrations of 0.3 g/l. Glycocoll has no distinct effect on the nickel deposit. Guanidine sulfate acts very harmfully in the nickel solutions, the nickel deposits being partly spongy to pulverant.

Hexamethylenetetramine, which is formed by the reaction of formaldehyde with ammonia, is similar in every respect to formaldehyde in its effects on the nickel deposits. Apparently this condition is due to the fact that hexamethylenetetramine is again decomposed in the solution.

Sulfur-Containing Compounds

Ethyl Mercaptan, Allyl Mustard Oil, Thiourea

Only orienting studies were made of ethyl mercaptan and allyl mustard oil since, even if these substances worked favorably as addition agents, their obnoxious odors would preclude their use. The concentration of ethyl mercaptan in the solution was increased up to 6.5 cc/l and that of allyl mustard oil up to 10 cc/l. Both substances produced a distinct, even if small, increase in reflectivity of the nickel, and no deterioration of the mechanical properties was observed.

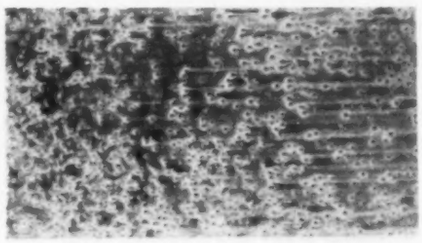


Fig. 6. Marked pit formation in nickel deposit from a solution containing urea. Mag. 2x.

The effects of thiourea were investigated very extensively. This substance causes a very strong increase in the brightness of the nickel coatings exceeding formaldehyde, by far, in its effect. An addition of only 0.15 g/l suffices to bring the reflectivity of the deposit up to that of buffed nickel (Fig. 4, Curve 9). The brightness of the deposits, as in the case of formaldehyde, is independent of the thickness of the nickel coating. The typical layered structure can be observed in a cross-section as in Fig. 2. The cohesion of thick coatings is weak. On bending, cracks occur not only in the spots of maximum bending, but the nickel exfoliates in thin sheets. (See Fig. 7).

When the nickel was heated, an unpleasant intensive odor was noticed. This odor could also be observed without heating, if the panels were bent. Small bubbles

5. One specimen of urea effected a marked increase in the brightness of the nickel deposits. Definite impurities were present which, however, could not be identified.

Fig. 7. Exfoliation after bending of a bright nickel deposit from a solution containing thiourea. Mag. 2/3x.

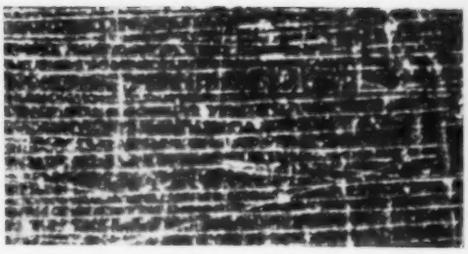


Fig. 8. Crack formation after bending a bright nickel deposit from a solution containing peptone.

Fig. 9. Blistered nickel deposit from a solution containing alpha-naphthol. Mag. 2/3x.

appeared everywhere on the surface, indicating gas formation. The gas that evolved from the nickel on heating, reacted distinctly alkaline, indicating, therefore, an amine. On dissolving the nickel in hydrochloric acid, hydrogen sulfide was evolved and in addition, traces of a gas smelling like methyl sulfide and which was not absorbed by alkaline or iodine solutions. Slimy and partly fibrous material formed on the anode during deposition, which apparently consisted of oxidation and polymerization products of thiourea.

Thiourea displaces the cathode potential current density curves very strongly to the negative side. At high current densities, the potential measurements were uncertain. Strong fluctuations occurred which led gradually to lower potential values. (Fig. 5, Curve 5). In an agitated bath, as to be expected, the increase in polarization declines (Fig. 5, Curve 5A).

Salts of mineral acids, for example, magnesium sulfate, do not alter the effects of thiourea. Sucrose and glycerin, which were added in quantities of 10 g/l and 35 cc/l respectively, repress the marked effects of thiourea. This type of solution gives only mat deposits which are not generally different from those obtained with sucrose or glycerin additions, without thiourea.

Cystine, the sulfur-bearing building stone of protein, has no distinct effect on the nickel in concentrations of 0.15 g/l.

Protein and Protein-Like Compounds

Albumin, Casein, Peptone, Glue

Proteins and their constituents have been used for a long time as brighteners in plating. Their effects are ascribed to their colloidal nature, which makes possible their codeposition at the cathode.

All proteins, however, do not act similarly. For example, slightly soluble casein, even in small quantities, is detrimental to the nickel solution during electrolysis. Scum formation occurs and the cathode is only incompletely covered with nickel which exfoliates from the base metal in the solution. The cathode potential fluctuates strongly after casein additions, and the obtaining of a usable cathode potential-current density curve is impossible.

Albumin, peptone and glue, have almost similar effects in the nickel solution. Additions as small as 0.01-0.05 g/l enable the obtaining of nickel deposits with high spectral reflectivity, which approaches that of buffed nickel (Fig. 4, Curve 10). The ductility of these deposits is bad. On bending, the specimens cracked in spots of greatest tension after relatively slight bends, the brilliance of the nickel increases with the thickness of the coating, and with the protein concentration of the solution. The reflectivity is independent of the thickness. With higher protein content, the nickel becomes discolored.

In determination of the cathode potential—current density relationships, pecularities were observed with small additions of protein which deviated from the normal conditions. In an agitated bath, a strong increase of the cathode potential is observed, but in a still bath on the other hand, only a small increase is observed (Fig. 5, Curve 6 and 6A). This can only be explained from the fact that with a small protein concentration in a still bath, the cathode film becomes quickly depleted through the deposition or decomposition of protein, but in an agitated bath, fresh protein is continuously brought to the cathode. An increase of the temperature to 55°C in a solution with peptone, led to a strong decrease in the brightness of the nickel, the brittleness only declining to a small extent.

Aromatic Compounds

Phenols, Naphthols, Ketones

Phenols, cresols, hydroquinone, resorcinol, pyrogallol, alphanaphthol, betanaphthol, nitronaphthol, nitrosonaphthol, quinhydrone, benzophenone, eugenol, camphor and morin. The effects of phenol, cresols and the numerous oxidized benzols on the brightness of nickel is, in general, small. Greater additions produce, with a few phenols, a strong increase in brightness but simultaneously, however, a marked degeneration of the mechanical properties occurs, and the nickel coatings peel, even in the solution, in scales from the base metal. In addition, phenols tend to hold the hydrogen to the cathode so that the coatings are always covered with numerous pits. α and β naphthols as well as nitronaphthol and nitrosonaphthol, even in small quantities, markedly affect the properties of the nickel solution. In concentrations of about 0.01-0.05 g/l, these materials effect a brilliance in the nickel deposits which approaches that of buffed nickel. The nickel is, however, brittle, and because of internal stresses, is covered with hair-like cracks. Thicker coatings exfoliate, even in the solution, in the form of coarse scales (See Fig. 9).

Cobalt-Nickel Plating Solutions

By Louis Weisberg, Ph. D.

Louis Weisberg, Inc.,
New York.

This paper embodies a complete discussion of low cobalt, nickel plating baths. The composition, functions of ingredients and operating characteristics are given. Information on the effects and control of impurities is included. Low cobalt nickel solutions give deposits which are semi-bright and ductile and which can be easily buffed.

Cobalt nickel alloy plating has found considerable application during the past five years. This use rests on the fact that these alloy deposits are definitely superior in certain respects to electrodeposits of either of the two metals separately. The advantages show up especially when bright or semi-bright deposits are required, and therefore it is in this field that the greatest use of cobalt in plating has taken place.

The addition of cobalt to an ordinary nickel plating solution is not enough to produce bright deposits. But adding cobalt together with suitable proportions of other substances such as formaldehyde, nickel formate, and ammonium sulphate does produce bright plate of excellent quality. If the amount of cobalt is kept low, the deposits do not attain their maximum luster and may be described as semi-bright. When the proportion of cobalt is increased, brilliant deposits, silvery white in color, are obtained.

The following is typical of the composition and conditions employed*:

	Ounces per gallon
Nickel sulphate	32
Nickel chloride	6
Nickel formate	6
Boric acid	4
Cobalt sulphate	0.2-2.0
Ammonium sulphate	0.0-0.3
Formaldehyde	0.3
Temperature	140°-160° Fahrenheit
pH (quinhydrone)	2.0-4.0

Current density (average)—40 amperes per square foot

Agitation of the solution or vigorous motion of the work is necessary to obtain maximum brightness. The oscillating cathode bar seldom gives sufficient motion. Accordingly mechanical stirring or air agitation is used in most cases where full brightness is required.

Dr. Louis Weisberg

The lower cobalt sulphate shown in the table above is employed where brightness is not the chief consideration. Under ordinary conditions, anodes containing about one per cent of cobalt are used with this amount of cobalt in the solution. The upper figure in the table represents as much cobalt in the solution as is necessary for maximum brightness, corresponding to anodes of approximately eighteen per cent cobalt content. As will be readily understood, in steady operation the cobalt content in the solution adjusts itself in accordance with the cobalt content of the anodes. For example, with five per cent cobalt in the anodes and other conditions as above, the cobalt sulphate in the solution approximates 0.5-0.6 ounces per gallon.

The cobalt content of the solution also varies with the prevailing current density, since the cobalt in the deposit is also a function of the current density. For a given composition of solution, the proportion of cobalt in the deposit falls off as the current density is increased. The following results are typical of what is found with a solution containing 2 ounces of cobalt sulphate per gallon, operating at 140° Fahrenheit and a pH of 3.7:

Amperes per square foot	Per cent Cobalt in Deposit
20	27.7
40	17.7
60	13.4
80	11.2

Regardless of variations in the composition of the alloy plated out with changing conditions, the average cobalt content of the plate is inevitably fixed by the composition of the anodes, unless one or the other metals is added in the form of salts. Alloy plating therefore is no more difficult than plating nickel alone. It is very seldom that the cobalt content varies enough to require special attention.

Function of Ingredients

The function and effects of various other ingredients of the solution require some explanation. The formate is used primarily for its buffer effect, which is very pronounced in the pH range between 3 and 4. It takes about 7 ounces of concentrated sulphuric acid to change

*This process is covered by patent No. 2,026,718 by Louis Weisberg and W. B. Stoddard, Jr.

the pH value of 100 gallons of this solution 0.1 of a unit. Compared with most other plating solutions, the pH value in these solutions tends to remain extremely steady. In addition to the buffer effect, formate makes a definite contribution to the brightness. One way of putting it is to say that it helps to produce greater brightness with any given proportion of cobalt. Another way in which its effect can be seen is at higher current densities; when the formate content is low, burning and clouding take place at high current density areas.

It may be wondered why boric acid is used in these solutions, since the formate acts as a buffer. The reason is that boric acid has two pronounced effects, both of which are favorable. It increases the limiting current density that can be used without causing burning to take place, and it improves throwing power. The metal distribution at different current densities is more uniform with boric acid present than without it.

Formaldehyde is the ingredient which is responsible for the major part of the brightness. Ammonium sulphate contributes some additional luster, but at the sacrifice of some ductility and an increase in hardness. Ammonium sulphate is used when maximum brightness, rather than maximum ductility and softness, is sought.

The character of the deposit varies considerably according to the pH value of the solution in which it is produced. Approximately 3.7 is the most favorable value from the standpoint of brightness. At pH values approaching 2, the deposits are considerably softer and more ductile, but less bright.

Variations in metal content from 4 to 12 or more ounces per gallon, chloride from 2 to 9 ounces per gallon, nickel formate from 3 to 6 ounces per gallon, boric acid from 3 to 5 ounces per gallon, and formaldehyde from about 0.23 to 0.6 ounce per gallon have been observed with no apparent effect on the satisfactory quality of the plate, such as brightness, ductility and throwing power. Such wide variations are bound to have some effect and are not recommended for optimum results. Nevertheless, they show that this type of solution has a wide working range and is practically foolproof. Simple methods of analysis are available for all ingredients of the solution.

Control of Impurities

The chief thing that has to be looked out for in these solutions—and for that matter in all known bright plating solutions—is control of impurities. Foreign substances may get into the solution in all sorts of ways. Nickel salts generally carry appreciable amounts of lead, copper, zinc and iron, and sometimes organic matter. Rubber linings for tanks carry vulcanization accelerators, antioxides and other materials that may be leached out by the plating solution and cause trouble. Anode bags and filter cloths may introduce sizing, unless carefully washed before use. Even the water used to make the solution has been known to contain undesirable matter. After the solution gets to working, polishing composition and lint may get by the cleaners, pieces are dropped in the tank and dissolve, metal may dissolve in a recess while the rest of the piece is being plated, and so on.

Constant vigilance is the only way to keep impurities under control. Fortunately much has been learned about this subject in the last few years, and platers are now beginning to take this in their stride as easily as they do chromium, which a dozen years ago was in about the same position as bright nickel today. Platers have taken hold of bright nickel more rapidly than they did chromium, I think, because the platers of today are much better grounded in the fundamentals of electroplating than their predecessors of only ten or twelve years ago.

Even with every precaution, it is not possible to keep impurities out of the solution completely. It is therefore necessary to have means for removing them.

It is only a few years back that Liscomb's method was the best known and mostly widely used method for purifying nickel plating solutions. This method is adaptable to cobalt-nickel solutions and so this is how these solutions were purified in the beginning. However, Liscomb's method no longer holds the position it once held. It takes a good deal of time, and may result in considerable loss of nickel unless carried out with the utmost care. Quicker and surer methods are rapidly displacing it. Many of the newer methods can be applied with no interruption to plating and have thus led to the growing practice of purifying continuously.

Two kinds of purification are generally used, one to remove organic impurities and the other to remove metallic impurities. Organic matter is taken out in most cases by adsorption on activated carbon or clay. This treatment is carried out by charging the carbon or clay into a filter and circulating the plating solution through it. While this is a simple thing to do if a suitable filter is at hand, it is important to keep any carbon from getting into the main body of the solution in the plating tank. Once it gets in, carbon causes rough deposits and is hard to get out. There is no danger of this happening if the filter cloths are precoated with filter aid before the carbon is put into the filter. Instructions for handling carbon properly are given in the 1940 Plating and Finishing Guidebook. The same practice should be followed with activated clay.

Activated clay does not adsorb as wide a variety of materials from plating solutions as activated carbon, but it is useful in some cases where carbon is not effective at all. Certain clays have proved particularly useful in treating embrittlement produced by organic matter.

Metallic impurities are easily taken care of by electrolyzing the solution at low current density. With good agitation, the impurities plate out preferentially at current densities of 1 to 5 amperes per square foot so that copper, lead, and zinc, which usually are the ones that cause most trouble, can be eliminated without much loss of nickel or cobalt. Copper and lead come out best at 1 or 2 amperes per square foot, while removal of zinc is more effective at 4 to 5 amperes per square foot. Some organic impurities can also be removed by electrolyzing in this way. For the small plating shop which lacks an adequate filter, electrolysis is the most practical way to purify the solution, whenever it can be done that way.

It is obvious that treatment with activated carbon or clay involves no interruption in plating. Purification by electrolysis can be carried out at the same time if the solution is circulated through a small auxiliary tank. In some plants, electrolysis for removal of impurities is carried on in the plating tank itself by splitting the bus bar so that a suitable current density can be maintained in part of the tank.

The amounts of various impurities that can be permitted to accumulate in the solution before their effects become apparent vary with a number of conditions, such as the nature of the work being plated, the current density used, the temperature, and above all the amount of agitation employed. The greater the degree of motion between the solution and the work, the less impurity it takes to show up. With little or no agitation, all the impurity near the cathode is quickly plated out and that in the body of the solution is too slow in coming up close to count. This disadvantage of agitation is partly offset by the fact that efficient purification is favored by good agitation.

Wide Operating Conditions

The type of cobalt-nickel plating solution described here can be operated under widely varying conditions, according to what one is after. To produce the brightest and most brilliant deposits, fairly high cobalt and a pH value approaching 3.7 would be desirable, the temperature varying between 130 and 160° Fahrenheit according to how high a current density one wants to use. When brightness is secondary, and easy buffing paramount, the cobalt content may be reduced to one or two per cent and the pH value dropped below 3, or even as low as 2. This would be the case, for example, where steel is plated without preliminary polishing to remove die marks and scratches, the cobalt-nickel plate then being buffed to cover up these imperfections. Extensive time studies have been made in several plants to find the best pH value at which to operate the solution so as to have the lowest possible cost of buffing. Obviously the best pH value in any given case depends on a number of factors, not the least of which is the set-up for buffing. It is interesting to find, however, that several different studies have led to a pH value in the neighborhood of 2.7-2.8 as the optimum. This represents a compromise between the softness obtainable at low pH and the brightness characteristic of higher pH.

The trend is definitely toward the use of less cobalt than was used when this type of solution was first put on the market. Several reasons for this may be noted. In the first place, experience in handling the solution and better control of impurities has made it unnecessary in a good many cases to use as much cobalt as formerly. Cobalt covers up the effect of impurities; so the more impurities the solution carries, the more cobalt is needed. Thus on polished brass, results are now being obtained with five or six per cent cobalt that formerly could not be obtained with certainty without two or three times as much cobalt.

Easy Buffing

Another reason for the trend to less cobalt is the fact that a great part—probably the greater part of all bright nickel applied is being buffed after plating, because this has proved more economical than putting a sufficiently high finish on the base metal before plating. This is especially so with steel. Many plants prefer buffing bright nickel to polishing off die marks, scratches, and similar imperfections on steel before plating. Zinc base die castings that have been plated in a Rochelle salt copper do not come up to a high finish in bright nickel unless the nickel deposit is quite thick, and so it may pay to buff either the bright nickel or chromium to bring up more luster. A good bright copper, which is now available, should change this situation so far as copper plated die castings are concerned.

Various bright nickel deposits show marked differences as regards ease of buffing. The low cobalt "semi-bright" deposit shows exceptionally favorable characteristics in this respect. Indeed, time studies have demonstrated it to be superior to the usual Watts' nickel solution. It also shows a considerable saving in buffs and composition.

Deposits Are Ductile

This type of deposit shows remarkable ductility. It should be noted that departures from this high standard can be traced to the effects of various impurities (metallic zinc, for example, or organic matter). Accordingly, strict control of impurities is essential to get the maximum ductility. Under favorable conditions, these deposits approach measurably near in ductility to the best soft gray nickel, which is the most ductile electrodeposited nickel that can be produced.

A severe test for adherence and ductility is to plate a tensile strength test specimen made of high carbon steel and watch the behavior of the deposit as the specimen undergoes elongation and rupture. If the deposit does not flake off under this test but adheres well and draws with the steel, it is suitable for use under the most exacting requirements. Tests of this kind have been made by impartial sources in order to compare cobalt-nickel deposits with other bright nickel deposits. The low cobalt-nickel deposits were found to be far superior to all the others.

The excellent physical properties of the cobalt-nickel deposits—both high and low cobalt—are strikingly shown when thick deposits are made. Some interesting applications based on the use of deposits 0.010" or more in thickness have been made as a result, especially where both hardness and ductility are required together.

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Ore smelting was practiced 1200 B.C. Excavations made at Oxford in Greek Macedonia show numerous fragments of rich silver ore dating back to the year 1200 B.C.

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Brazil has the world's deepest mine. This is the St. John del Rey gold mine, in the state of Minas Geraes. It is 1¼ miles deep and has been worked for nearly 100 years. Its yield of gold has run as high as $2,500,000 in a year.

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All weights were at one time taken from grains in the middle of an ear of wheat. The word "grain" remains to the present time in the troy table, a pound troy being 5,760 grains, which is used for weighing silver and gold.

+

Since the enactment of the presidential proclamation nationalizing silver in 1934, $1,000,000,000 of the taxpayers' money has been spent to acquire more than 1,700,000 ounces of silver for the government.

+

The oldest known map in the world is one that shows the gold regions of Egypt.

+

The United States Mint Officials estimated recently that 5,000,000,000 pennies have been misplaced or lost since the government started making them. The government turns out copper pennies or to be exact, one cent pieces, at the rate of 2,871 a minute each working day.

Health Hazards in Electroplating

By J. P. Russell, M. D.

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California State Dept. of Public Health

This paper was presented to the annual convention of the Los Angeles Branch of the A.E.S. held in March. A comprehensive story of health hazards in plating and finishing is given. Methods of control of health hazards, and physiologically hazardous aspects of grinding, degreasing, acid dipping, chromium plating, cyanide and other plating solutions are presented. Pathological symptoms are also given.—Ed.

Introduction

Industrial hygiene is a comparatively new field of work, but one which is rapidly growing in importance. Its purpose is the protection of health, the improvement of efficiency, and the prolongation of life of industrial workers; in other words, adult health conservation. The control of occupational diseases, bears the same relation to the health of adults as does the prevention of communicable diseases such as diphtheria to the health of children.

During the past twenty years, great improvement has been made in working conditions in industry. Most employers now recognize the economic, as well as the humanitarian value of providing healthy surroundings in the workroom. They know from experience, that maximum efficiency and economy of operation require careful attention to the upkeep of the human machine as well as the iron one. They realize that a sick workman is a liability rather than an asset to his employer, as well as to himself. If he becomes too sick to work, he must be replaced by another man. In the case of skilled labor, this often means a lengthy and expensive training period.

We are all familiar with the great strides that have been made in the prevention of industrial accidents, and the development of safety devices. However, up until recently, the compensation phase of occupational diseases was emphasized, rather than constructive efforts being made along preventive lines. It is now generally recognized that long before a worker who has an occupational disease becomes a compensation case, his health has been impaired and his working ability decreased.

One important reason why occupational disease prevention has lagged behind accident prevention, is that only in the past few years have instruments of precision and laboratory methods been developed for the accurate study and control of conditions causing these diseases. Extensive research work, and clinical and laboratory studies have established the toxic threshold or maximum safe concentration of many of the potentially harmful materials encountered in industry.

Industrial hygiene, which for many years was considered as being concerned only with the prevention of occupational diseases, is now recognized as a much broader field than this. The modern concept of industrial hygiene is that it also includes many related problems, such as industrial lighting and ventilation, sanitation, fatigue, hours of labor, overcrowding, personal and mental hygiene, and medical and nursing services.

Industrial injuries and diseases in the United States cost more than five billion dollars a year. Occupational diseases cost more in money, as well as in health, than do accidents, since the efficiency of a worker who has an occupational disease in an early stage is diminished long before he is completely incapacitated; while in the case of an accident, his working ability remains at par up until the accident. Progressive industrialists now know that it is cheaper for them to provide adequate protection against accident and health hazards, than to wait until after a disease or accident occurs and then pay more in compensation and insurance costs than prevention would have cost in the first place.

The injurious effects on the human body of materials found in industry may be classed roughly as local and systemic. The local effects include such conditions as skin irritations, eye injuries, and burns. Of these, the skin effects, or dermatoses, are by far the most frequent. In California, about two-thirds of all reported occupational disease cases fall within this group. Systemic effects may be produced by absorption of toxic materials through the skin, as in the case of tetraethyl lead; by inhalation into the lungs, and absorption from there directly into the blood stream, as in the case of most gases and vapors; or by entrance into the body through the digestive tract from contaminated food or other objects which are put into the mouth.

Control of Health Hazards

No arbitrary rules or codes can be prescribed for the control of all industrial health hazards. Each plant, and each workroom in the plant, is a problem in itself, requiring detailed, individual study. However, certain basic principles are commonly utilized in the control of occupational health hazards. These include (1) the substitution of a harmless, or comparatively harmless material for the dangerous one, such as the use of steel shot or nail whiskers in place of sand for the abrasive cleaning of castings, and the use of petroleum distillates in place of carbon tetrachloride and benzol as degreasing agents; (2) the isolation or mechanical enclosure of the harmful process, such as the use of spray painting booths and welding

booths; (3) wet methods of handling materials which are capable of producing injurious dusts, such as wet grinding and drilling; (4) local exhaust ventilation to trap harmful dusts or gases at their sources and to prevent them from reaching the worker's breathing level; (5) the use of personal protective devices, such as positive pressure air helmets, respirators, gas masks, goggles, and protective clothing; (6) personal hygienic measures, including frequent washing, bathing, and change of work clothing; (7) reduction of length of exposure by rotating workers in hazardous jobs, or by shortening working hours; and (8) selection of the least susceptible individuals for occupations involving exposure to harmful materials such as dusts, fumes, gases, and skin irritants.

Physical examinations of industrial workers are one of the most important and valuable features of an adequate health program. All new workers should be given complete physical examinations prior to employment. not for the purpose of excluding them from work, but as a guide to their intelligent placement in the type of work for which they are best suited physically, and to prevent those who are suffering from communicable diseases, such as active tuberculosis and syphilis in a contagious stage, from passing them on to fellow workers. Each employee should be given a periodic physical examination for the purpose of detecting physical defects and diseases in their early stages, when proper corrective measures will prevent much needless suffering and loss of time and money.

Hazards in Electroplating

Health hazards in the electroplating industry may be encountered in grinding, polishing and buffing; in degreasing; in acid dipping or pickling; in plating; and in spraying with lacquers and enamels.

Grinding—Silicosis

In cutting and grinding operations the eyes should be protected from injuries by flying particles of metal and abrasive, by wearing safety glass goggles. During grinding and polishing, many invisible dust particles are thrown into the air. If these particles are inhaled in high concentrations over prolonged periods of time, they are capable of causing inflammation and scar tissue formation in the lungs. This is particularly true of dust containing free silica.

Silicosis is a disease of the lungs which is due to breathing air containing free silica dust. The development of this disease depends upon the number, or concentration, of dust particles in the air, the size of these particles, the percentage of free silica in the dust, the length of exposure, and individual susceptibility.

Studies of silicotic lungs have shown that most dust particles which have reached the smaller air passages are less than ten microns, or 1/25 hundredth of an inch in diameter. The larger particles, which may be visible to the naked eye, do not cause silicosis, since they are caught by the mucous membranes and hairs lining the nose and windpipe, before they reach the lungs. Atmospheres containing many dangerously small silica dust particles may appear deceptively dust-free to the naked eye, since particles smaller than 100 microns in diameter are usually invisible without the aid of instruments. To determine accurately the amount of dust in the air, samples should be taken close to the breathing level of exposed workers. These samples should be collected by trained persons with special apparatus. For this purpose, we have found the technique recommended by the U. S. Public Health Service, using the wet impinger dust samplying apparatus, to be the most reliable and accurate. The maximum quantity of free silica dust which may be breathed over a prolonged period of time, without danger of health impairment, is five million particles smaller than five microns in diameter, per cubic foot of air breathed.

Small dust particles in the air are carried about like smoke, and settle out slowly. A particle of silica dust, one micron in diameter, falls at the rate of about one foot per hour in quiet air. Therefore, dust-laden air is not only an immediate hazard, but may remain dangerous for a period of many hours.

Silicosis is slow to develop. It usually requires five years or longer of exposure to silica dust, even in high concentrations, to produce the disease; but once it has developed, there is no known cure, and it tends to progress even after the individual is removed from further exposure to the dust.

The most characteristic symptom of the disease is a gradually increasing shortness of breath, which becomes more and more pronounced, due to the replacement of normal lung tissue by scar tissue. In the early stages, the individual may look and feel well, and may even put on a little weight. Later, a dry cough develops, and there is usually a tendency to catch cold easily. The disease is seldom, if ever, fatal in itself, but it renders the victim particularly liable to develop tuberculosis of the lungs, which is the usual cause of death in these cases.

The diagnosis of silicosis is based on the patient's occupational history, his symptoms, physical examination, and, most important, on X-rays of the chest. Without X-ray findings, a diagnosis is difficult, if not impossible.

Silicosis is the most costly of all the more common occupational diseases. The average case costs the industry about ten thousand dollars. The number of damage suits based on alleged silicosis has increased to such proportions that it jeopardizes the future existence of not a few industries. Pending damage claims for silicosis are now estimated to amount to several hundred million dollars.

This disease can be prevented by keeping dust containing free silica out of the air that workers breathe. This may be accomplished effectively in electroplating plants by segregating dust-producing operations, and by installing exhaust ventilating hoods over grinding and polishing wheels. Exhaust ventilation applied to the source of dust production is the most effective means of protecting workers against a dust hazard.

Silicate dusts are also capable of causing scar tissue formation in the lungs, but the hazard is much less than in the case of free silica dust, and silicates apparently do not predispose to pulmonary tuberculosis as does silica.

Degreasing

Degreasing and cleaning of metal parts involves possible exposure to irritants, such as alkalies, and to poisonous materials such as carbon tetrachloride, trichlorethylene, benzol, and gasoline. In working with even weak alkali solutions, the hands should be protected with rubber gloves, or protective ointments, and should be washed

frequently with soap and water. Stronger corrosives may cause serious burns when they come in direct contact with the skin and mucous membranes.

Poisoning by chlorinated solvents, such as carbon tetrachloride and trichlorethylene, may occur from inhaling their vapors, or from prolonged contact of these liquids with the skin. The vapors of these solvents cause irritation of the eyes, nose, throat, and lungs. These liquids also remove natural oils and fats from the skin, and thus may cause dermatitis. When these substances are absorbed into the body in large quantities, or over prolonged periods, they may cause damage to the liver, kidneys, and other vital organs. The signs of internal or systemic poisoning are often delayed in their appearance. Chronic poisoning results from long-continued exposure to small amounts of chlorinated solvent. The early symptoms of poisoning by these solvents include smarting of the skin, burning of the eyes, irritation of the nose and throat, headache, loss of appetite, nausea, and slight mental confusion. Trichlorethylene, in some cases, causes an addiction, due to its pleasing anesthetic or intoxicating effect when its vapors are inhaled.

The prevention of poisoning by solvent vapors depends upon reducing the exposure of the worker to within safe limits, which, in the case of carbon tetrachloride, is 0.01% of the vapor in the air breathed by the worker. This may be accomplished by the use of enclosures, hoods, and exhaust ventilation applied to sources of escape of the vapors; substitution of less toxic solvents; or the wearing of special respiratory protective equipment, such as air-line respirators, or hose masks. Air currents in the vicinity of the degreasing tank should be minimized, and the heating of the solvent should be controlled thermostatically. The efficiency of control measures should be checked at intervals by determining the concentration of vapor present in the air at the breathing level of workers, and by medical examinations, including blood and urine analyses. All good solvents are toxic to some extent, and any excessive exposure to their vapors should be avoided. This applies not only to continuous exposures, but also to comparatively short periods, which are repeated at intervals.

Where benzol is used as a degreasing agent, there is the possibility of poisoning from inhaling the vapor. This causes injury to the blood-forming structures of the body. The early signs of chronic benzol poisoning are frequent headaches, dizziness, loss of appetite, increasing pallor, and weakness. The safe limit of benzol vapor in the air is 50 parts per million parts of air breathed. Control measures for the prevention of benzol poisoning are the same as those which apply to carbon tetrachloride and trichlorethylene.

Acid Dipping and Pickling

In acid dipping and pickling operations, the worker may be exposed to the vapors of hydrochloric, sulphuric, and nitric acids, or these acids may come in direct contact with his skin. If strong acid solutions are used, exhaust hoods should be provided over the pickling tanks for the removal of vapors.

The severity of acid burns on the skin and mucous membranes, depends upon the concentration of acid, and the length of time it is in contact with the tissues. Strong acids and alkalies cause intense smarting when they touch the skin. The smarting may diminish in a few minutes because of a numbing effect, but this does not necessarily mean that tissue destruction has stopped. Acid fumes cause a choking sensation, and irritation of the eyes and nose. A sudden burning sensation in the eyes should call for immediate attention. Weakness, hoarseness, chronic cough, and tooth decay are warning signs of early acid fume poisoning.

At the first sign of smarting or burning of the skin, the worker should immediately wash the affected part with plenty of water. Clothing soaked with a corrosive should be removed at once. Washing with an abundance of clean, running water is a more effective and safe first-aid treatment for acid and alkali burns than attempts to neutralize them with chemicals. Important measures in the prevention of burns by acids and their fumes include local exhaust ventilation applied to tanks from which fumes may escape; an ample supply of water immediately available to all employees working with corrosive chemicals; and personal protective equipment such as goggles, rubber boots, aprons, and gloves.

Chromic Acid

The health of men working at electroplating tanks may be jeopardized by exposure to chromic acid and chromates.

Chromic acid, in the form of a dry dust, or as a spray from plating tanks, is strongly corrosive. Its burning, destructive action occurs when the dust, vapor, or liquid comes in contact with a crack or abrasion in the skin. Chromium solutions apparently do not attack the unbroken skin. However, the smallest break, especially where the skin is thin, such as over the knuckles or between the fingers, provides a portal of entry for the destructive process which, once it has begun, penetrates gradually through the soft tissues. The ulcer is characteristically sluggish; the edges are clear cut, and look as though they are punched out, which accounts for the term "chrome hole," which is often applied to these lesions. This ulcerating process frequently attacks the septum of the nose. Once the mucous membrane is destroyed, the blood supply to the cartilage is cut off, and tissue destruction follows. The bony tissues are never attacked, rigidity of the parts is maintained, and there is no deformity. The onset of chrome ulcers of the nose is accompanied by sneezing, and the ordinary symptoms of a cold in the head. The pain is seldom severe enough to cause loss of time from work. The only apparent inconvenience which results is the formation of mucous plugs in the nose. Other common sites of chrome ulcers are the roots of the fingernails, the knuckles, and the eyelids.

The maximum concentration of chrome acid dust or vapor which may be present in the air without danger to health, is one milligram in 10 cubic meters of air. The concentration may be kept below this safe threshold, by means of a properly designed system of local ventilation.

Natural ventilation is seldom, if ever, adequate for this purpose. Upward local exhaust ventilation is effective, because it draws the chromic acid spray past the face of the operator. The most efficient method of ventilation is to draw the air laterally across the top of the plating tanks into ducts from one to two inches wide, extending along the entire length of one or more sides of the tank. The duct should not have to draw the air a lateral distance

of more than 18 inches. In tanks more than 18 inches wide, exhaust ducts should be installed on both sides, or two ducts should be placed over the middle of the tank. The level of the plating solution should be kept at least 8 inches below the exhaust duct opening. Air velocity at the duct should be about 2000 ft. per minute. Obstacles to the air current, such as large projecting anodes, or racks, should be avoided.

Chromium plating tank operators should protect the tissues of the nose, by applying to them several times daily, a film of vaseline or some similar protective coating. Rubber boots, gloves, and aprons, should be worn whenever possible to prevent contact of chromic acid with the skin. If gloves are not worn, the hands should be washed frequently with water, and coated with a mixture of 3 parts vaseline, one part lanolin or wool fat. Floors near plating tanks should be washed down frequently. Operators should have periodic medical examinations, and any skin or nose abrasions should be treated promptly by washing with 5% sodium bisulphite, ammonium polysulphide, or thiosulphate solution, after which ichthyol ointment, and a waterproof covering should be applied.

Cyanides

The use of cyanide solutions in electroplating work introduces a health hazard which calls for protective measures. Gases evolved from the electrodes carry some cyanide into the air, in addition to the spray from the tanks. The maximum concentration of hydrogen cyanide which may be breathed over a prolonged period, without danger of poisoning, is 100 parts per million parts of air, or 0.01%.

While chronic cyanide poisoning is uncommon, cases have been reported. The symptoms are headache, dizziness, weakness, nausea, and vomiting, a bitter-almond odor of the breath, indigestion, irregular pulse and breathing, shortness of breath, and muscular pain and trembling.

Contact of cyanide solutions with the skin may cause an eczema-like dermatitis. The lesions occur primarily as irritating pimples, or water blisters. Scratching of these eruptions often leads to secondary infection. Skin abrasions and open cuts are particularly liable to be affected. Dermatitis due to cyanides may be prevented by scrupulous personal cleanliness, including frequent washing, by the use of protective ointments, and the wearing of rubber gloves. Cyanides should never be handled with the bare hands.

As in other plating operations, adequate local ventilation of tanks is the most effective means of preventing the escape of cyanide vapors to the breathing level of workers. Cyanides should not be used near acids, since an accidental mixture of these materials may produce hydrocyanic acid gas, which is highly poisonous.

Nickel Solutions

Nickel solutions coming in contact with the skin may cause a form of dermatitis known as "nickel itch," which begins with a sensation of burning and itching of the hands, often involving the nails, and sometimes extending over the entire body. This condition affects only a small percentage of persons coming in contact with nickel, and is apparently due to an allergy, or hypersensitivity, on the part of the affected person. This sensitivity may be determined by making skin patch tests with the material suspected of causing the skin irritation. Prevention of nickel itch consists in removing from exposure the occasional worker who is found to be susceptible, or in personal protection, including frequent washing, and the use of gloves and protective ointments.

Cadmium

The salts of cadmium, particularly the sulphate, carbonate, and oxide, may cause irritation of the respiratory tract, and gastro-intestinal disturbances. Fatal cases of poisoning by cadmium fumes have been reported. The symptoms of cadmium poisoning include weakness, shortness of breath, vomiting, headache, dryness of the throat, and bronchitis. It has been found that the safe limit of cadmium vapors in the air is 0.1 milligran per cubic meter. Electroplating tanks in which cadmium is used should be equipped with efficient local exhaust ventilation to prevent the escape of cadmium fumes.

The use of chemically impure electrodes, or other materials in electroplating, may cause poisoning by the impurities present, such as arsenic, lead, and mercury.

Arsenic

Chronic arsenic poisoning results chiefly from breathing, over a long period of time, air containing dusts or sprays of arsenic compounds. Absorption through the skin is slight, but arsenic is quickly absorbed if it is swallowed or inhaled. The breathing of arsenic, in the form of arsine or arsenuretted hydrogen gas, may cause acute systemic poisoning, which attacks the blood, the blood-forming organs, and the nervous system.

The symptoms of chronic poisoning by arsenic and its compounds include frequent headaches, skin ulceration, bronze discoloration of the skin, loss of hair and nails, loss of appetite, nausea, irregular diarrhea, and general muscular weakness.

Arsenic dust and fumes should be trapped at their point of origin by exhaust ventilation. Persons who are physically under par should not be exposed to arsenic compounds.

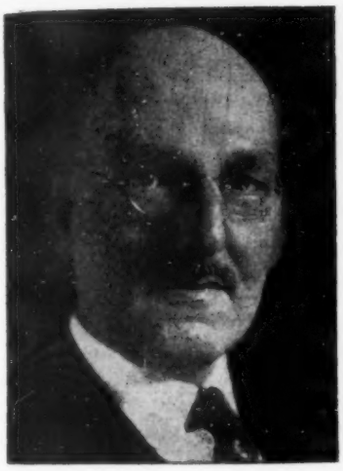
Lead

Lead poisoning may result from swallowing lead compounds, or by direct absorption through the skin, but is usually due to breathing lead dust and fumes. When lead gets into the body, it circulates in the blood, where it destroys the red blood cells, and is finally deposited in the bones. Susceptibility to lead poisoning varies in different persons. In the early stages of lead poisoning, the individual is often restless, moody, excitable, and experiences headache, dizziness, constipation, and abdominal cramps, loss of appetite and weight and pains in the joints. A blue-black lead line may appear on the gums, at the base of the teeth.

The prevention of industrial lead poisoning depends on the removal of lead dust and fumes at their point of origin: good personal hygiene, cleanliness of hands and fingernails, frequent baths, and change of clothing; frequent physical and blood examinations of exposed workers to detect early signs of lead absorption; and the removal of susceptible individuals from further exposure. The maximum safe concentration of lead dust and fumes

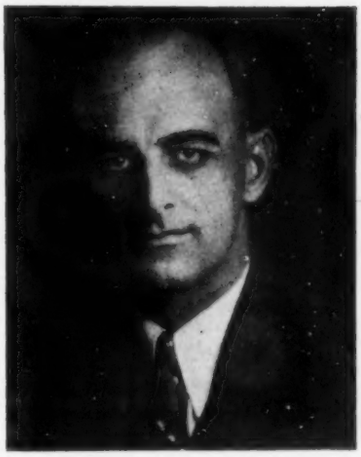
(Continued on page 328)

Spring Electrochemical Society Meeting Held at Wernersville, Pa.



George B. Hogaboom
Elected a vice-president of the Society

Prof. Frank C. Mathers
Elected president of the Society



Dr. A. Kenneth Graham
General-chairman of the Wernersville meeting

The Electrochemical Society held its 77th Semi-Annual Meeting at Wernersville, Pa., April 24-27.

The meeting was well attended, with 30 technical papers being presented. *Dr. A. Kenneth Graham* was general chairman of the meeting and *R. L. Baldwin* was vice-chairman.

Dr. F. C. Mathers, Professor of Chemistry, Indiana University, was elected president of the Society. The officers for 1940 are as follows:

President

Frank C. Mathers, Dept. of Chemistry, Indiana University, Bloomington, Indiana.
Term expires 1941

Past President

H. Jermain Creighton, Dept. of Chemistry, Swarthmore College, Swarthmore, Pennsylvania.
Term expires 1941

Vice Presidents

D. A. Pritchard
Alexander Lowy
J. D. Edwards
Terms expire 1941

E. M. Baker
G. B. Hogaboom, Sr.
M. deK. Thompson
Terms expire 1942

Managers

R. B. Mears	*C. E Villiams*	*S. D. Kirkpatrick*
H. E. Haring	*K. G Soderberg*	*A. K. Graham*
L. C. Judson	*J. A. Lee*	*R. L. Seabury*
Terms expire 1941	Terms expire 1942	Terms expire 1943

Treasurer

R. M. Burns, 463 West Street, New York City
Term expires 1941

Secretary

Colin G. Fink, 3000 Broadway, New York City
Term expires 1941

An important meeting of the Electrodeposition Section was held with an extended discussion on how to improve the sessions on electrodeposition. The concensus of opinion was that it would be preferable to hold one meeting a year on electrodeposition rather than dividing the papers between both the Spring and Fall Sessions. Close cooperation with the American Electroplaters' Society was also urged. *Richard O. Hull* of the Dupont Company, Cleveland, was elected chairman of the Electrodeposition Section. *R. T. Gore* was re-elected vice-chairman and *Dr. Harold J. Read* was re-elected secretary-treasurer. Other division chairmen are:

Electronics—*Marlin E. Fogle*
Electrothermic—*P. H. Brace*
Theoretical Electrochemistry—*Malcolm Dole*
Electro-Organic Chemistry—*Sherlock Swann, Jr.*

The twelfth *Weston Fellowship* of $1000 was awarded to *Waldemar P. Ruemmler* of St. Louis, Mo. Mr. Ruemmler will continue his research at Columbia University under *Prof. Colin G. Fink*, investigating the electrodeposition of antimony.

The Fellowship was founded by *Dr. Edward Weston*, one of the foremost pioneers in electrochemistry.

Dr. George A. Moore of Princeton, N. J., was awarded the Society's prize to young authors, for his paper entitled, "The Comportment of the Palladium-Hydrogen System Toward Alternating Electric Current." Dr. Moore is an instructor in metallurgy at Princeton University, Princeton, N. J.

Abstracts of Some of the Papers Presented

PAPERS ON ELECTRODEPOSITION

A Study of the Electrolysis of the Sodium Cuprocyanide Solution.

By J. V. Petrocelli

The cathode and anode polarization values of copper in sodium cuprocyanide solutions of various concentrations have been determined. By using Fick's diffusion law as a guide, it is shown how the kinetic electrode potentials can be interpreted from the point

of view of the diffusion process as well as from the ratio of copper to cyanide ions. Some cathode and anode efficiencies were also obtained in order to show their dependence on the electrode solution potential and the diffusion process.

I. Single Metal Deposition of Copper, Cadmium, Zinc and Nickel from Thiosulfate Solutions.

By D. C. Gernes, G. A. Lorenz and G. H. Montillon

Results are presented of an investigation to determine the possibilities of using thiosulfate baths for single metal deposition, and to determine the behavior of these baths during deposition. It was felt that the investigation of any complex salts which might be useful in deposition would be of both theoretical and practical value in this field. For each metal, copper, cadmium, zinc and nickel, considerable preliminary work was done to determine bath composition, need of agitation, range of temperature and of current density, to produce good deposits and high current efficiencies wherever possible. In depositing copper, a cuprous chloride is needed which is essentially free of cupric compound. Following the favorable preliminary results, each metal bath was studied further so that recommended bath compositions and plating conditions could be given, in addition to the more detailed account of its behavior. Very unusual results were obtained in the electrodeposition from the nickel baths, in that all deposits contained both nickel and sulfur, with a minimum of 22% S. Experimental evidence strongly indicates that the sulfur is present in the form of nickel sulfides, especially as Ni_3S_2. These results have led to the recognition of a new type of cathodic reduction which causes the deposition of a *compound* in metal-like form. The cadmium deposits also contain sulfur, but only about 5%. On the other hand, copper and zinc deposits are apparently metals. Possible mechanisms during deposition are indicated.

Recent History of Certain Cobalt-Nickel Alloy Plating Solutions.

By Louis Weisberg

Developments in the commercial electrodeposition of cobalt-nickel alloys during the past two years are described. Improvements in methods of removing impurities have made it possible to reduce the cobalt content of the deposit, for some purposes, as low as one per cent. Substitution of nickel formate and formic acid for sodium formate and use of less ammonium sulfate have resulted in deposits that are more ductile and easier to buff than those formerly obtained.

The Structure of Heavy Electrodeposits of Copper and Nickel.

By J. W. Cuthbertson

The aim of this work has been to investigate and attempt to offer a satisfactory explanation of the structural anomalies revealed from an examination of a heavy nickel deposit and of several heavy copper deposits.

As regards the copper specimens, the effect of current interruption has been shown to cause semi-discontinuities in the structure, but as to how dangerous this type of defect may prove in practice, it is difficult to say. It is certain that annealing has a deleterious influence on such deposits, greatly increasing the brittleness, as in the case of nickel. So far as could be judged from simple hammering tests, the un-annealed striated deposits were not particularly brittle and in some cases were quite malleable. The un-annealed deposits showed directional variations in the x-ray structure and in the Brinell hardness.

Un-annealed nickel specimens cut from the uniform central part of the square cathode, and not incorporating metal from the overgrown edges of the plate, proved to be extremely ductile and completely free from brittleness. Annealing invariably caused rapid loss in ductility and the development of a brittle type of structure. The particular deposit examined showed wide variations in the crystal grain size from one region to another, but this effect probably would be minimized if suitable precautions were taken in the preparation of the cathode and throughout the deposition process. It is not the writer's intention to discuss these precautionary measures at this point, but reference may be made to an excellent account of present-day practice in heavy nickel plating recently published by Bonilla, from which much useful information on the subject can be obtained. Finally, the existence of an intense fibre structure in the electrodeposited nickel, oriented perpendicularly to the cathode, has been demonstrated.

Progress in Electrolytic Refining of Metals, with Special Reference to the Last Decade.

By Max F. W. Heberlein

This review of the last decade covering the electrolytic-refining of metals indicates that, throughout the world, development work on copper and the precious metals has been predominating. This is partly due to the fact that these metals are economically and commercially more important than others. On the other hand, the electrolytic methods are the only efficient refining methods for copper and the precious metals; whereas fire-refining methods for other metals are more economical in many cases.

Electrolytic Stripping of Copper from Zinc Base Die Castings.

By W. B. Stoddard, Jr.

Copper can be stripped from zinc base die castings in a chromium plating solution using a.c.

CrO_3	200-500 g./L.
Ratio CrO_3:SO_4	100:1
Temperature	20°-25° C.
Current density	7-14 amp./dm.^{2}
Alternating current	50-60 cycle.

After stripping, the zinc surface is activated by dipping the articles into cold, dilute hydrochloric acid (10 cc./L. of HCl, sp. gr., 1.19).

Stress in Electrodeposited Copper as Determined by X-Rays.

By Elbert M. Mahla

The relative amount of stress in deposits of copper made at different temperatures and current densities was determined by the measurement of the elongation of the spots on a Debye-Scherrer transmission x-ray film relative to their width. Stress was plotted against current density and temperature in a three-dimensional diagram. In deposits made at low temperatures, temperature was shown to be a greater factor than current density in determining the stress, while at high temperatures current density was the principal factor. No direct relationship between hardness and stress was observed.

PAPERS ON THEORETICAL ASPECTS OF ELECTRODEPOSITION

The Theory of the Potential and the Technical Practice of Electrodeposition.

I. The General Problem and the Cases of Uniform Flow

By Charles Kasper

There is no field of technology which so involves and so well illustrates the theory of potential as that of electrodeposition. A detailed exposition and discussion are presented of the flow of current through the electrolyte when the electrodes are: (a) parallel planes, (b) concentric cylinders, and (c) concentric spheres.

The Theory of the Potential and the Technical Practice of Electrodeposition.

II. Point-Plane and Line-Plane Systems

By Charles Kasper

The considerations of Paper I are extended to solve slightly more involved problems in potential distribution, such as line-plane systems. These simple problems clearly demonstrate some of the methods of the theory of the potential. Their fundamental application to electrolytic systems is considered. The only meaning that can be ascribed to an experimental proof is that the conditions of the computations have been satisfied. The improvement of current distribution in commercial practice is so complex that the theoretical approach can be employed only to present a clear picture of the situation.

The Application of Electromotive Force Measurements to Binary Metal Systems.

By Harry Seltz

Electromotive force studies of solutions of electrolytes have contributed to some of the most important advances in the understanding of the nature of such solutions. Today in the Debye-Huckel theory we have a better theoretical basis for the treatment of electrolytes than for any other type of solution. On the other hand, binary liquid metal solutions, which at first sight might be thought to be relatively simple in nature, have received little attention. The thermodynamic properties of only a few such systems have been previously investigated. In our laboratories we have undertaken electromotive studies of the lower melting metal systems to supply additional data which we hope may lead eventually to some satisfactory theory of metallic solutions. The results obtained indicate that, in some cases at least, the problem may be a complex one. In this paper we shall discuss the experimental work and show how the thermodynamic properties of the solution can be evaluated from the electromotive force measurements. These thermodynamic data are then applied to the calculation of phase equilibria and to the calculation of the entropies, free energies and heats of formation of any intermetallic compounds which may occur.

MISCELLANEOUS PAPERS

Electro-Organic Chemical Preparations. II.

By Sherlock Swann, Jr.

This review is an extension of an earlier list of electro-organic syntheses which should be of value as methods of preparation to include literature published before January, 1940. For the sake of clarity the subjects in this paper have been numbered exactly as in the previous one. A letter has been appended to the numbers of tables introducing new subject matter except where it occurs at the end of the paper.

Most of the literature in this paper before 1936 consists of incidental electrochemical preparations found in the experimental sections of organic chemical papers. This literature was not available when the last survey was written.

A list of errata and explanatory notes referring to the 1936 survey will be found at the end of this paper.

The Electrolytic Etching of Brass.

By G. C. Williams and G. Rieger

This paper reports an easy and effective method of electrolytically etching brass specimens for metallographic examinations. The procedure may be extended to numerous copper alloys. The etching solution is an ammoniacal ammonium acetate, sodium sulfite solution. The specimen is made anode at a current density of 31 amp./dm.^{2}

The Electrochemical Oxidation of n-Hexanol.

By William Robert Lowstuter with Alexander Lowy

n-Hexanol was oxidized electrochemically, giving n-caproic acid and n-hexyl caproate. Besides these main products, small amounts of carbon dioxide, carbon monoxide, and a high boiling residue were obtained. Hexaldehyde and decane were not found to be present in the products of the electrolysis. A study was made of the various factors influencing the oxidation, such as anode material, temperature, current density, solvent, and alcohol concentration of the anolyte for the electrolytic oxidation of n-hexanol. The best results were obtained under the following conditions: (a) 5% sulfuric acid as electrolyte; (b) current density, 1.1 amp./dm.^{2}; (c) temperature, 12° C.; (d) electrolytically prepared lead dioxide anode; (e) anolyte concentration, 82 g. n-hexanol in 800 cc. of electrolyte; current efficiency, 59.9% calculated only as oxidation to caproic acid.

X-Ray Analysis of Corrosion Products from Galvanized Sheets.

By F. R. Morral

The structures of basic zinc salts are very involved and subject to change, making the interpretation of the x-ray photograms of random corrosion product samples difficult. No attempts were made in this preliminary investigation to determine quantitatively the amounts of the various compounds present in the corrosion products. For a more formal study, a close control in all of the stages of the investigation would be necessary. Quantitative analysis by x-ray and electron diffraction methods should be made of the corrosion products and their surface films *in situ*.

X-ray analysis of corrosion products from hot-dipped galvanized sheets shows that the compounds present are, mainly, zinc oxide, basic zinc carbonate, a double salt of zinc hydroxide and zinc carbonate. The chemical composition of the zinc coating and the character of the environment determine how the average mass of the corrosion product is made up. For a better understanding of the process of corrosion of hot-dipped galvanized sheets, experiments with closely controlled conditions are necessary. The surface film should be investigated by means of electron diffraction, and the corrosion products by means of x-ray diffraction methods.

Some New Developments in Corrosion Resistant Steel.

By George F. Landgraf

A corrosion resistant steel, serviceable under every condition met with in practice, does not exist and probably never will. Although the 18/8 stainless steel is highly resistant to nitric acid solutions, it is readily attacked by hydrochloric acid solutions. The addition of copper and molybdenum increases the corrosion resistance of the 18/8 alloy to sulfuric acid solutions. The recently developed silver-bearing 18/8 is much more resistant to chloride solutions than the original 18/8 alloy.

Photoelectric Cells Sensitive to Long Wave Length Radiation.

The Bismuth Sulfide Cell

By Colin G. Fink and Johnstone S. Mackay

This investigation comprises a study of photocell materials. The principal development is a new photoelement using bismuth sulfide as the photoactive material. The characteristics of this cell were studied and it was found that a laboratory-prepared bismuth sulfide cell has 80% of its activity in the infra red range of the spectrum, gives 5 microamperes per lumen and has a threshold wave length of approximately 7.0 microns (70,000 Angstroms).

Some Experiments Showing the Directional Reactivities of Single Crystals of Copper.

By Allan T. Gwathmey and Arthur F. Benton

New experiments were carried out which show the variations in reactivities of surfaces prepared parallel to the different crystal planes of a single crystal of copper. A striking etch-pattern was obtained when a single crystal in the form of a sphere was immersed in mercury for four hours and the mercury evaporated from the surface by heating in a vacuum. The influence of dissolved gases such as oxygen, hydrogen, and carbon dioxide on the etch-patterns produced by the corrosion of copper by liquids was investigated. The variations in reactivity of surfaces parallel to the different crystal planes are shown to be of importance in the problem of corrosion. The effects of variations in current density, concentration, and nature of the electrolyte on the patterns obtained when a single crystal was electrolytically etched were studied. Quantitative measurements were made of the different rates of electrolytic etching of surfaces parallel to the different crystal planes.

Stainless Steel Rolled Products.

By P. B. Greenawald

Stainless steel is an electric furnace product which has found many applications in factories, stores and homes. The hardness and other physical characteristics can be varied within relatively wide limits. The presence of the high percentage of chromium in the steel necessitates close control during electric furnace melting. The commerical success of stainless steel is due primarily to the electric furnace and the ability to keep the carbon content of the alloy down to 0.10%. The working of stainless steel was

difficult at first but marked improvements in composition and heat-treating have been made so that today the stainless steels are worked very much like carbon steels. The machining of stainless steel was likewise difficult at first but the addition of small percentages of sulfur or selenium to the alloy has solved this problem. The surface of stainless steel can be made mirror bright, practically matching chromium plate.

Cold Welding of Silver. II.

By G. R. Van Duzee and J. M. Thomas

Pressure welding of silver sheet was studied at temperatures from room temperatures to red heat. By pre-heating the silver to redness, then allowing it to cool, complete welds were secured at room temperature both with "999.3 fine" silver and with spectroscopically pure silver. When the spectroscopically pure silver was pre-heated, complete welding took place at room temperature under a pressure of 4,950 kg./cm.^{2} (70,000 lb./sq. in.) applied for 30 seconds. Similarly treated 999.3 fine silver sheet showed only slightly lower weldability. The spectroscopically pure silver which had not been pre-heated before welding showed a much lower weldability than when heated to redness immediately before pressure was applied. When there had been a pre-heating treatment, welds were obtained consistently when 4,950 kg./cm.^{2} (70,000 lb./sq. in.) was applied for 30 seconds; without pre-heating no welds at all were formed under the same conditions and the welds formed under a pressure of 7,000 kg./cm.^{2} (100,000 lb./sq. in.) applied for 30 seconds were unsatisfactory. Good welds were obtained, however, at 9,100 kg./cm.^{2} (130,000 lb./sq. in.). Comparative tests with gold sheet showed similar advantages obtained by heating to redness before pressure application. Results of welding tests with 999 fine silver powder and "proof" silver powder are given.

A Theory for the Passivity of Chromium.

By Sister M. Aida Ryan, O.S.F., and Herbert Heinrich

In an attempt to discover the true cause of the phenomenon of passivity, numerous chromium plates were produced, exposed to various conditions and then tested for their activity. The theories that have previously been advanced to explain the phenomenon of passivity do not take into consideration the behavior of chromium under all of the conditions imposed upon the metal in the authors' experiments; therefore, a theory based on the electronic structure of chromium has been formulated. According to this theory the atoms on the face of each unit cube of chromium share the electrons in their outermost orbits in such a way as to bring about a stable condition. To this complementary relation is attributed passivity of the metal.

Oxidation-Reduction Potentials and Their Applications. A Review.

By Samuel Glasstone

A brief review is presented of the various directions in which oxidation-reduction potential measurements have been applied in recent years. Such measurements are of importance not only to the chemist but also to the biologist. Among the applications discussed are potentiometric titrations; indicator action; indicators for biological reactions; and irreversible potentials.

Improvement in Quality of Metal Deposits Due to Rotation of Cathode Applies Likewise to Metal Deposits by "Displacement".

By Roberto Piontelli

A careful analysis is made of the various conditions that affect the structure of electrodeposits. Attention is directed in particular to the improved structure of electrodeposits made on rotating cathodes. Metal precipitates obtained by displacement or cementation are likewise investigated, and theoretical considerations lead to the prognostication that rotation of the less noble metal would improve the quality of the cemented metal. Actual experiments fully confirm the author's deductions. Zinc rods were rotated at a peripheral speed of 1.8 m./sec. (5,000 r.p.m.) in solutions of silver, copper, lead, thallium and cadmium. Compact micro-crystalline, adherent, cemented metal precipitates were obtained.

Health Hazards in Electroplating

(*Concluded from page* 324)

in the air is 1.5 milligrams per 10 cubic meters of air.

Mercury

Mercury, like lead, is a cumulative poison. It may enter the body by way of the mouth, by absorption through the skin, or most important, by inhalation of the vapor or finely divided dust. Young persons, women, and alcoholics, are particularly susceptible to the toxic effects of mercury. Chronic mercury poisoning develops gradually, and often without conspicuous warning signs. The more common early symptoms of chronic poisoning are general weakness, exhaustion, inflammation of the mouth, loosening of the teeth, soreness of gums, excessive salivation, pain on chewing, emotion instability, restlessness, self-consciousness, and tremors of the hands, head, and face, which are increased when attention is focussed on them. Mercury is eliminated from the body in the urine, feces, saliva, and sweat.

The toxic threshold, or maximum quantity of mercury which may be taken into the system without danger of cumulative poisoning, is between one and two milligrams a day. The precautions which are effective in preventing lead poisoning also apply to protection against mercury poisoning in electroplating plants. The air in workrooms where mercury compounds are used should be tested frequently, to determine the amount of mercury dust and vapor present. All workers exposed to mercury should be given periodic medical examinations to detect early signs of poisoning.

Mercury compounds and solutions coming in direct contact with the skin of susceptible persons may cause a chronic dermatitis. This condition may be prevented by personal cleanliness; by the use of gloves and protective ointments; and by identifying, by means of skin patch tests, persons who are hypersensitive to mercury dermatitis, and removing them from further exposure.

Lacquering

When plated objects are sprayed with lacquer or enamel, this work should be done in booths or cabinets equipped with local exhaust ventilation to prevent the escape of toxic solvent vapors to the breathing zone of sprayers. The degree of health hazard connected with lacquer and enamel spraying, depends chiefly upon the type of solvent and thinner used. Therefore, it is important that the nature of these materials be known. Supplied-air respirators may be used to protect men exposed to toxic vapors, but should not be relied upon as substitutes for local exhaust ventilation, where the latter method of control is feasible. A minimum air velocity of 150 linear feet per minute at the face of paint spray booths is necessary to prevent the escape of poisonous vapors into the general workroom atmosphere. In the case of lead-containing paints, this should be increased to 200 feet per minute.

Cooperation Required

Effective work in industrial hygiene can be accomplished only by the close cooperation of the physician, the engineer, and the chemist. The physician is responsible for the diagnosis of occupational diseases, and the recognition of symptoms of ill health which are due to faulty conditions in the working environment.

PLATING AND FINISHING
POLISHING — BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

SHOP PROBLEMS

Technical Advisors For June Issue

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When sending solutions for analysis please give following information: name and address; class of work being plated; kind of solution and volume; length, width and depth of tank; temperature of solution; current density, cleaning sequence and any other pertinent facts.

Gold Plating Brass Moulding

Q. We are planning to gold plate a lot of brass moulding varying from 2 inches to 4 inches in width to 10 feet in length and three-eighths of an inch in thickness. Specifications call for a gold deposit of 0.0005" thick. Will you kindly send information as to the making and operation of the solution for properly handling this job. There are approximately 2500 square inches to be plated in a group consisting of 40 pieces and it is essential that we maintain a uniform shade.

A. In regard to your gold plating problem, let me say that either the cyanide or chloride bath can be used. Generally speaking, the cyanide bath has better throwing power and gives a smoother deposit. However, the acid bath can be used at a higher current density and gives a higher cathode efficiency. A formula for the acid solution consists of gold chloride, 20 g/l, and hydrochloric acid, 15 g/l. This can be used at room temperature or elevated temperatures. The current density can vary from 10 to 50 amps./ft.^{2}, depending upon the agitation. Soluble gold anodes should be used with this solution.

A good formula for a cyanide bath consists of: potassium gold cyanide, 15 g/l; (1.55 g = 1 pennyweight); free cyanide as potassium cyanide, 20 g/l; potassium carbonate, 30 g/l. Grams per liter may be converted to ounces per gallon by dividing g/l by 7.5.

The gold chloride salts may be purchased on the market, or may be made by dissolving electrolytically the gold as an anode in a hydrochloric acid solution. The gold cyanide may be made by two methods. First, the gold can be cut down or dissolved by pouring over the material aqua regia, which consists of 1 part nitric acid to 3 parts hydrochloric acid. After all the material is dissolved, the solution should be boiled down, cooled and then just neutralized with ammonium hydroxide. A precipitate of gold fulminate will settle to the bottom of the container. Filter the solution and discard it. To the precipitate, add just enough potassium cyanide to take up the insoluble material. Then add the desired quantity of free cyanide. After the addition of the potassium carbonate, the solution is ready for plating. Care must be exercised in handling gold fulminate as it is *explosive when dry*. The second method consists of dissolving the gold electrolytically by the porous cup method. May I refer you to METAL INDUSTRY, March 1940, page 154, for a description of this process.

The above solutions can be used with a soluble gold anode or an insoluble stainless steel anode. In the latter case, gold must be added from time to time as the fulminate or cyanide.

It is possible to obtain prepared salts on the market from reputable firms. See METAL INDUSTRY.

For your information, in a coating of 0.0005" there are 22.7 grams per sq. ft. of gold or 0.73 Troy ounces per sq. ft. of gold. To deposit this thickness of gold at 10 amps./ft.^{2} from the acid solution, requires 56 minutes. From the cyanide solution, the time required is 18 minutes. The above is based on 100% current efficiency. The efficiency of the acid bath is around 95%, while that of the cyanide is approximately 65%.

—C.B.F.Y.

Finishing Small Jewelry

Q. I would like a little information regarding finishing of small articles, such as rings and medals, which have been hard-enameled in some parts and have been pickled in dilute sulfuric acid. The trouble is that when I polish these articles, I have a difficult job in getting a bright finish on them. There is a film or cloudy smut which I have to remove first before I can obtain the

required bright finish. Is there a different way to pickle them, as this only happens on the enameled work which has to be heated and pickled twice.

A. Without doubt, the reason that a smutty cloud is visible after polishing on the mentioned silver rings and medals is, that the articles have not been pickled sufficiently after they have left the hard enameler's furnace.

Work to be hard-enameled should be pickled in a 10% solution of sulfuric acid and wet scratch-brushed, to assure bondage and a clean, clear surface for transparent hard enamels.

The customary procedure for pickling after enameling is to place the articles in a copper ladle containing a 10% solution of sulfuric acid. Place ladle with contents over gas burner and allow to come to a boil. Pour off sulfuric acid solution into stock solution, then rinse in warm water to avoid cracking of enamel. Place the work into an acid resistant basket and dip in nitric acid (3 parts nitric acid, 1 part water) for approximately 30 seconds, while agitating. Rinse in water, scratch-brush wet, then dry and polish, or, if the work is of a flat nature such as the medals, then lap the enamel on a felt wheel using pumice and water; dry, then proceed in the usual way of polishing and coloring.—P.A O.

Silver Plating

Q. I have to silver plate copper contacts with a coating from 0.003"-0.004" thick. The plating solution which we are using contains 20 g/l of potassium silver cyanide and 11 g/l of potassium cyanide. I am getting good adherence of the silver to the copper but even with a current density of 2 amps/ft.², treeing is present, and the silver anodes get covered with a greasy color. The voltage drop across the bath is about 50 volts.

Our procedure for silver plate is as follows:

(1) Dip parts in a hot proprietary cleaner solution.
(2) Rinse in cold running water.
(3) Dip in a pickling bath composed of nitric acid with a little salt and lamp black.
(4) Rinse in hot running water.
(5) Bright dip.
(6) Rinse in running cold water.
(7) Dip in a quicking bath.
(8) Rinse in cold running water.
(9) Place in plating bath.

The current density is controlled by means of a lamp bank.

A. The sequence of operations as given in your letter is satisfactory. The use of a mercury dip on parts that might be subjected to heating is a doubtful procedure, however. A silver strike should be used instead. Silver strike:

Silver cyanide	0.5 oz.
Sodium cyanide	8.0 ozs.
Water to make	1 gal.

Use 6 volts.

This coats the metal with a preliminary film of silver instead of mercury.

It is noted that you have a total silver anode surface of about 27 sq. in. at the most. This is counting the back of the anode which is not all effective area. At this rate, the current density figures out to be (on the anodes) about 15 amps/ft.². This is part of your trouble. The high anode current density causes the anodes to polarize (coat over) and this, as you say, sets up a resistance which makes the voltage rise. Due to the fact that you are operating from a 220 volt line, the voltage can increase to large values, and if the resistance is high enough, can approach 220 volts.

Increase the anode area by at least twice and preferably three times. Do not use tinned hooks. Tin in the solution will contribute to treeing and may also be another factor in causing the anodes to coat over, as under some conditions, tin will go to the anode. Use heavy steel hooks, and submerge the joint where hook comes into anode. If desired, the anode rod can be made of heavy steel rod, and run just beneath the surface of the solution. Use cold rolled steel, or if hot rolled, first pickle off the scale.

Your plating solution is a very weak one for heavy deposits. Not only this, but the low free cyanide is another factor in the poor anode corrosion obtained. A better formula would be:

Silver cyanide	4.5 ozs.
Potassium cyanide	7.0 "
(or sodium cyanide)	(5.5) "
Potassium carbonate	5.0 "
(or sodium carbonate)	(5.0) "
Water to make	1 gallon

—G.B.H., Jr.

Hand Forged Aluminum Finish

Q. The writer would like to know the method for producing a hand forged and hammered finish on aluminum ware, similar to the sample sent you.

A. Unfortunately, there appears to be no standard procedure for finishing aluminum ware, and the following information is offered in the hope that it will be of some use. Much of the hammered ware on the market is made, not from aluminum, but from Kensington metal. This metal has a different color than aluminum and the surface appearance will be different from that obtained on aluminum of the 2S type. For further information, consult the Aluminum Co. of America, Pittsburgh, Pa.

Many formulae have been published in the literature for producing a black color on aluminum. See either the 1939 or 1940 Plating & Finishing Guidebook Other formulae are:

Ammonium molybdate	10-20 grams
Sodium acetate	5-20 "
Ammonium chloride	1 gram
Water	1 liter

Work must be mechanically (not chemically) cleaned.

Arsenic trioxide	1 oz.
Ferrous sulfate	1 "
Hydrochloric acid	12 ozs.
Water	12 "

Antimony trichloride	1 oz.
Hydrochloric acid	12 ozs.
Water	87 "

A mat finish can be produced as follows: immerse in a strong hot alkaline solution, such as caustic soda; rinse and remove the black smut in 1 to 1 nitric acid; rinse and dry.

There are several grades of greaseless compositions available and for these we suggest that you consult the manufacturers.

+

Hammered copper instruments in their actual setting underground, were recently unearthed near Rochester, N. Y., indicating that a more advanced state of civilization than had been suspected existed in this region over 1,500 years ago. The copper from which the tools were made is supposed to have come from the Lake Superior region.—*Joseph Danforth Little.*

ELECTROPLATING DIGEST

SELECTED ABSTRACTS ON PLATING—FINISHING—RUST PROOFING—LACQUERING

Bright Plating Solutions

U. S. Patent No. 2,171,842, *H. J. Barrett & C. J. Wernlund, assignors to E. I. du Pont de Nemours & Co., September* 5, 1939. The addition of polyvinyl alcohol or a compound of same as a brightener for zinc, cadmium, nickel, tin and copper alloy baths. Patent claims use only in zinc solutions. Amount required is 0.01-0.5 g/l. (In amounts above 1 g/l., the deposit is hard and brittle). Deposit is claimed to be bright even in recesses at low current densities when followed by the usual bright dip for zinc deposits.

Example:

Zinc cyanide	75 grams/liter
Sodium cyanide	37.5 " "
Caustic soda	75 " "
Sodium sulfide	0.25 " "
Polyvinyl alcohol	0.026-0.52 grams/liter

Anodes: Electrolytic zinc + ¼% mercury. Anode to cathode ratio: 3:1. Temp.—25-30° C.

Bright Chromium

U. S. Patent No. 2,172,344. *M. Brown, A. M. Wagner* and *W. Yonkman*, assignors to Western Electric Co., Inc. *September* 12, 1939. Process for plating heavy and bright chromium by correlating the current density and temperature according to the curve, as shown in a solution containing:

Chromic acid	250 g/l
Sulfate	1-5 "

Using a current density of at least 2 amps./sq. in. and temperature between 40° and 90° C., and adjusting the cathode to anode ratio to 1:3. The ratio should be kept below 1:5.

Protecting Magnesium

U. S. Patent No. 2,178,977. *M. Tosterud*, assignor by mesne assignment to Magnesium Development Corp. *November* 7, 1939. Production of corrosion resistant films on magnesium by immersion in alkali metal dichromate and a salt from the group consisting of zinc sulfate and cadmium sulfate at pH 4-5. Example:

Potassium dichromate	100 g/l
Zinc sulfate	50 "

Immerse 30 minutes, rinse and dry. pH 4.4-4.8.

Protective Coating for Aluminum and Alloys

U. S. Patent No. 2,171,545. *J. D. Edwards & R. B. Mason*, assignors to Aluminum Co. of America. *September* 5, 1939. A method of improving paint adherence on aluminum and its alloys by first etching with a hydrochloric acid solution containing 0.02%-1.0% of a metal from the group consisting of manganese, iron, copper, nickel and cobalt. Then treat with a 1.0%-10.0% solution of chromic acid to remove residual chlorides and contaminating substances which might induce corrosion beneath the paint film.

Example:

Hydrochloric acid	1 volume
Water	2 volumes
Manganese sulfate	4 g/l

At about 100° F.

The metal accelerates the etching of the aluminum. If a smut remains, it may be removed by immersing in equal parts of nitric acid and water.

Alkaline Cleaning

U. S. Patent No. 2,186,523. *S. R. Dodd*, assignor to Oakite Products, Inc. *January* 9, 1940. To inhibit the formation of a chromate film on articles immersed in an alkaline cleaner, due to chromic acid being transferred by means of the racks, a compound is claimed containing an aldehyde group and having not more than one hydrogen atom in the alpha position to the aldehyde group and compounds capable of yielding such aldehyde compounds in alkaline solutions. Part of the agent to develop its action immediately on solution, such as furfuraldehyde or dextrose, and part to have inhibiting powers only after some time in solution such as starch and sucrose. Examples of inhibitors:

Furfuraldehyde	10
Dextrose	60
Starch	30
or:	
Dextrose	60
Sucrose	40

Examples of inhibited cleaner compositions:

1.	Soda ash	30-70
	Sodium pyrophosphate	5-25
	Soap	0.2-20
	Furfuraldehyde	5-20
2.	Sodium hydroxide	10-30
	Sodium metasilicate	20-50
	Trisodium phosphate	10-20
	Dextrose	5-20
	Starch	5-20
3.	Sodium orthosilicate	50-80
	Sodium resinate	5-15
	Dextrose	5-15

Ordinarily 10% inhibitor is used to 90% cleaner but where the racks are broken and hold chromic acid, the inhibitor may be increased to 10-25%.

Removal of Gold Deposits

U. S. Patent No. 2,185,858. *S. R. Mason*, assignor to Western Electric Co., Inc. *January* 2, 1940. Process of removing deposits of gold, silver, palladium, etc., from copper, copper alloys and zinc by making articles anodic in sulfuric acid of specific gravity 1.65 and at a temperature below 100° F., the sulfuric acid containing a small amount of chromic acid or single nickel salts when freshly prepared to help the action. The sulfuric acid probably forms persulfuric acid at the anode which dissolve the gold. When the gold is carried away from the anode film it precipitates again and accumulates as a mud at the bottom of the tank. The process results in no attack on brass, etc.

Brightening Agent for Silver

U. S. Patent No. 2,176,668, *B. Egeberg & N. Promisel, assignors to International Silver Company, October* 17, 1939. A process of electrodepositing silver from silver cyanide solutions containing urea or substituted ureas as a brightening agent. Example:

Silver cyanide	25 grams
Potassium cyanide	45 "
Potassium carbonate	20 "
Urea	45 "
Water	1 liter

Temp. = 80°F. Current density = 6 amps./sq. ft.

Pickling Chromium Steels

U. S. Patent No. 2,172,041, *S. F. Urban, September* 5, 1939. A process and pickling solution for descaling chromium alloy steels, containing at least 12% chromium, comprising:

Hydrofluoric acid	½—10% by volume
Chromic acid	5—10% " "
Sulfuric acid	1—10% " "
Water	Balance

To be used hot or cold. Does not pit or corrode the surface of the article.

Pickling Inhibitor

U. S. Patent No. 2,172,291, *R. H. Patch, assignor to E. F. Houghton & Co., September* 5, 1939. An acid pickling inhibitor comprising a sulphurized cinchona alkaloid and a heterocyclic 5 membered ring compound containing both sulfur and nitrogen atoms.

Example:

Sulfurized quinoidine	20 parts
2-Mercapto-4-phenyl benzothiazole	10 "
Sodium chloride	70 "

Use 1 part by wt. of the above mixture to 100 parts of wt. of acid.

Post Scripts

Notes on the First Dayton Meeting in 1915

George B. Hogaboom was working for the International Silver Company, Meriden, Conn., and presented a paper on copper plating. He had a little more hair in 1915 than he has today.

•

Walter Barrows was elected president and gave a paper on cobalt plating.

•

H. J. Ter Doest read a paper on tin plating, and we notice that this subject is also to be discussed at the 1940 meeting.

•

Messrs. *Lamoureux* and *Fraine* were the guiding lights of these meetings.

•

The population of Dayton has grown from 132,000 in 1915 to over 200,000.

•

The 1915 meeting was a three-day affair, starting on Thursday morning, June 3rd and ending Saturday evening, with a banquet.

•

Wilbur G. Stratton of the Bridgeport Branch, and now retired, was elected second vice-president.

•

An amendment was passed to the constitution allowing assistant platers, who had served five consecutive years, to become associate members.

•

At Leacrest

Tariff takers *Eddie Jarms* and *Bill Starr* reported that 190 platers and friends attended. *Colin Hastie* was conspicuous by his absence.

Donald Wood, with the perennial pipe, about to approach Ye Post Scripter for a choice saying which never materialized.

•

Bob Leather has installed what he claims to be the only proper bomb-proof shelter in Conn. The shelter also serves as a "screamatorium" which is a place where one can scream to his heart's delight at full blast without having the neighbors send for those men in white coats. The destructive desire, which often accompanies the scream cure, is satiated by the presence of a barrel of apples for smashing against the wall of the "screamatorium."

•

Donald Wood spent a few hours trying to secure some choice sayings for the Lea notebook to replace those of Shakespeare, Darwin, Mark Twain and others. The sayings obtained were choice all right, but were reminiscent of Confucius and other unprintables.

•

Tom Chamberlain beat *Earle Couch* at breaking the clay pigeons but both were overshadowed by *Carl (Lux Clock) Hungerford.*

•

Charlie Koelbl played the piano accompaniment to some raucous voices moved to the spirit of song by the cup that cheers. Charlie is taking an active part in the affairs of the New Haven Branch of the A.E.S.

•

Jack (A. C. Gilbert) Gormley spent some time as a fifth man in a quartet and the rest telling about claims of wonder regarding a 40 second cleaning cycle in his plating room.

•

A large Irish wolfhound has been the mascot at the parties for some time. Rumor hath it that gargantua first belonged to *Ray O'Conner* who couldn't afford to feed it and so gave it to *Bob Leather.*

•

The weather was dreary and drizzly and no baseball game was played. Sport consisted of trap shooting, archery and elbow bending.

•

An unsung artist is *Roland (Frederick Gumm Chemical Co.) Doucette* who has, for several years, done yeoman's duty as purveyor of ginger ale, cider and malted milk behind the brass rail. On snapping his picture for posterity, Roland said, quote, "its about time that my genius has been recognized; I've been pitching here without recognition so long that I was beginning to think I was the forgotten man."

•

Add *Art Logozzo* of G. E., Pittsfield, Mass. and *Joel Backus* of Silex Co., Hartford to the growing list of platers who were either born or who worked in Meriden, the Silver City.

•

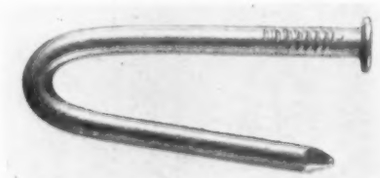
All were saddened to learn of *George Knecht's* illness. George who represents H-VW-M Co. in Conn., has suffered a heart ailment and at the present writing, is in bed. He is of an active nature and is finding it hard to relax and stay out of harness. Our best wishes go toward your prompt recovery, George.

•

The scene was a side show and more particularly a strong man act. The strong man was heating a soldering iron with a blow torch and the act was to brandish the iron at the audience and defy them to grab it, which of course, they didn't, at least ordinarily. However, there was a young fellow in the audience who had watched the proceedings and saw that the iron tip was actually in the reducing portion of the flame and couldn't be heated very hot, and so he grabbed the iron much to the strong man's dismay and with the attendant swooning of a few women.

The strong man then proceeded to the part of his act in which he bends a spike with his hands after much face making. The same young fellow, who weighs about 145 lbs., laughed at the spike bending and said, "That's easy, I could do it myself."

"Bet you $50 you can't."



Spike bent by our hero with his bare hands.

"I'll take that bet," said the young fellow and while the strong man ridiculed our hero's efforts, the latter quietly bent the spike which we have herewith reproduced. The denouement was that our hero never could collect the bet, but at least he had lots of fun.

Who is our hero? Why, he will be at Dayton and his name is *Derick S. Hartshorn, Jr.*, the secretary of the Springfield, Mass. Branch of the A.E.S.

•

Austin Wilson is Grandpa Wilson now. You wouldn't believe it to look at him though.

•

At Waterbury

The meeting at Waterbury was held at the same time as the meeting of the state Democratic committee. It was a double

header meeting for *Jim Hines* who is one of the powers of the state Dems. and a staunch A.E.S. man. Ex-governor *Wilbur Cross* showed that he is still a politician by shaking hands with everybody in sight. Maybe platers look like politicians to him. *Eddie Cantor* was also supposed to be in town but it may have been somebody with exopthalmic goiter.

•

George Morrow (Egyptian Lacquer Co.) was abetted by two other masters of confusion or were they George in two different disguises. The ladies who attend *Dave "Oakite" X. Clarin's* Aunt Ella's party are in for a treat as George is to perform his feats of magic at that time.

•

Burt Daw, president of LaSalco, told us one of the few stories that we can print in Post Scripts. It concerns a fellow who had alternated beer and whisky in his drinking, much to the amazement of the waiter. Finally, the waiter's curiosity got the best of him and asked why he drank beer and whisky alternately. By this time the somewhat inebriated gentleman replied, "when I drink beer, I am full before I am drunk, and when I drink whisky, I am drunk before I am full—so beer and whisky make me drunk and full at the same time."

•

Ed Lavellee performed at the microphone, much to the sorrow of the audiance at the banquet. Ed was somewhat poor on hitting various notes of the scale but whatever his voice lacked in quality, he made up in volume.

•

Bill Schneider (Dupont Company) who was sporting a Florida tan played doctor for *Arthur Mintie*, prescribing Arthur's food during dinner.

•

George Karl and *Harry McFadyen* spent about an hour in their room arguing about their health and beauty. Either George or the Mrs. must have been feeling rather low in the morning, as we overheard them ordering "strangled eggs."

•

Fred Norgren, the well-liked Frederic B. Stevens representative in Connecticut, has a fancy Norgren Special, to be eaten any time between 2 and 5 A.M. It consists of alternate layers of pancakes and eggs, the order being pancake, egg, pancake, egg, pancake.

Picture taken at Dayton 25 years ago. Left: Carl Dittmar of Dupont company, and right, Charles H. Proctor, founder of the A.E.S.

We were informed some time ago that *George Gehling* had an accident when his car and a taxi collided. The taxi took the brunt of the collision and we are glad to say George was not hurt.

George Gehling in a serene and contented moment, snapped at Fred Gumm's party.

The great Scandinavian myth which *Oscar Servis* had built up around himself in years past blew up like a sniff of snuff in Hollywood recently. For years, Oscar has created the impression—or never denied it—that he was so proficient in the Swedish language that King Gustav V himself was a second-rater by comparison.

Came then the night of April 1. Oscar and *Mrs. Servis* and *Mr.* and *Mrs. Frank J. Hanlon* played host to the Los Angeles friends who had entertained them so lavishly during their two weeks in Southern California in March. Present to witness the forthcoming Swedish debacle were *Mr. and Mrs. Ernest Lamoureux, Mr. and Mrs. Don Bedwell, Mr. and Mrs. Clarence Thornton* and *Mr. and Mrs. M. D. Rynkofs.*

The scene was a Hollywood cafe known as "A Bit of Sweden." Oscar himself chose it, never dreaming of the Waterloo he was to meet before even the first platter of Smorgasbord had made the rounds. The cafe management prides itself on the fact that all the waitresses speak Swedish as fluently as English, a fact Oscar was unaware of.

Well, Oscar tried out his version of Swedish on one of the waitresses. She replied. Both stared at each other blankly.

"Is—is that Swedish you're speaking?" asked Oscar, bewildered.

"Yes, sir," replied the girl. "What language were you speaking?"

A chuckle echoed along the table, loudest in the vicinity of the Hanlons.

"Gracious," Oscar tried to bluff it out. "These girls aren't Swedish. Why, I can't understand a word this one says."

Then he grinned broadly. "What a Swede I turned out to be!" he observed.

There was small chance of keeping Oscar's downfall secret, for his table companions had heard so much of his asserted prowess as a Swedish linguist that someone was bound to spread the news.

And someone did.

Ben Popper celebrates his 39th year with Egyptian Lacquer Mfg. Co., on July 5th of this year. *Charlie Schlott* is also an Egyptian old-timer celebrating his 35th year with the company also on July 5th. Both Ben and Charlie are regular and popular attendants at the annual A.E.S. conventions.

•

Boston appears to be in line for the 1940 convention of the A.E.S. and if successful in winning the vote, *Joe Barron* will take up *Charlie Conley's* job.

•

Wilfred S. "Liquid Sulphur" McKeon is planning to fly to Dayton hoping to join the A.E.S. Special at Pittsburgh.

•

"Jimmy, I wish you would learn better table manners; you're a regular little pig at the table."

Deep silence on Jimmy's part. So father, to impress him more, added, "I say, Jimmy, do you know what a pig is?"

"Yes, sir," replied Jimmy, meekly. "It's a hog's little boy."

•

Leroy Beaver, when speaking to the Bridgeport Branch of the A.E.S. in April, mentioned that the brass companies years ago used to barrel burnish by rolling the work in wine barrels and to get a good job, they would have to roll the barrels a distance equivalent to 5 trips between Waterbury and Winsted. *Ray O'Conner* opined that this wasn't as bad as it sounded as there was plenty of hard cider along the way to relieve the monotony.

•

Leroy was interested in our remarks about his speaking as fast as *Floyd Gibbons*. He said that he knew Floyd Gibbons personally and never could match the word flow of Gibbons which was over 300 words a minute. Leroy's record is about 275 per minute.

•

It was pleasant to see *John Feeley* at Boston. He carried coals to Newcastle in his speech urging the members to make Montreal the next convention city.

•

John Oberender pinch-hitted for *Charlie Conley* at Boston and did a good job.

•

It was a good many years ago—in fact the 1915 meeting in Dayton. It was the custom at the early meetings to have each member or guest arise and state his name and position. After almost all the members had stated John Jones, etc., of the Blah Blah Company, a young man arose in the back of the room and said: "The name is Dr. Wm. Blum of the Bureau of Standards; I have nothing to sell."

•

Proctor Electric Co., Philadelphia, Pa., recently finished their one-millionth iron. As it came off the conveyor, it was found to be a reject. It happens in the best of families.

See You At Dayton

Walter R. Meyer

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

Steel Fabricated Polishing and Buffing Lathes

Chas. F. L'Hommedieu & Sons Company of Chicago, Ill. have put out a new line of steel fabricated polishing and buffing lathes in which the motors are mounted in the base entirely enclosed and when desired, a variable speed device (on which the company has applied for a patent) is mounted on a shaft of an ordinary motor. Thereby one can obtain any speed between 1500 and 3000 R.P.M. or a ratio of 2 to 1.

Overhung type lathe.

Two of the new type lathes are illustrated in this column. Other types are shown in the advertising section. It is claimed the speed can be changed from low to high merely by turning the hand wheel in the rear of the lathe as one would turn the steering wheel of a car.

Front view of No. 22 lathe.

By maintaining the peripheral speed of your buff, better work in much less time and the saving of buff and compositions is claimed.

New Industrial Baskets

The Carpenter Metal Products Co., 446 E. 131st St., Cleveland, Ohio, have developed a line of new industrial baskets, different from the perforated line, also produced by this company.

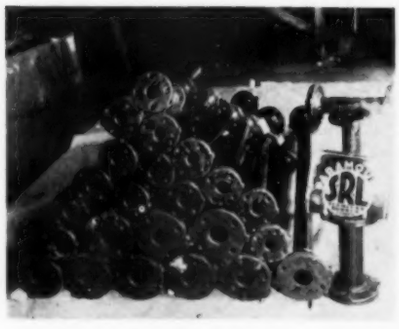
The photograph shows a new type basket made for the Leece-Neville Company, used in heavy production. This basket is made of round bars and flat bars with heavy perforated bottom and shelf. This has a swing handle as shown, can be made of any size, to hold any weight and of any metal depending on the use of basket, whether it is to be used for quenching, cleaning or in acid baths for plating, dipping or otherwise.

Heavy duty basket.

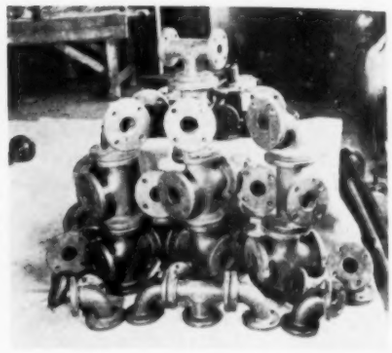
New equipment has been added to the plant to facilitate rapid manufacture of the new type baskets.

Seamless Rubber Lined Pipe and Fittings

The pipe and fittings shown in the photographs are illustrative of the seamless rubber-lined technique developed by the Paramount Rubber Service, Inc., 1430 Rosedale Court, Detroit, Mich., after eight years of development in the application of rubber to metal.



Seamless rubber-lined pipe with flanges 100% insulated.



Seamless rubber-lined pipe fittings with 100% insulation inside and out.

The firm announces its readiness to supply SRL pipe and fittings to the chemical-using industries. All units to one-foot long are given complete insulation, both inside and out, including flanges and bolt holes. Longer lengths are given application of the company's rubber paint to exterior surfaces back of the flanges. Flange couplings are flexible and there can be no "freezing" of bolts in the rubber-lined holes.

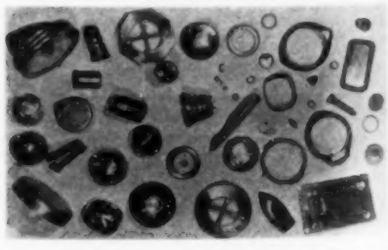
The rubber is built up from specially treated metal surfaces to the required thickness with complete absence of seams and laps. A special quality rubber to withstand severely corrosive conditions is used.

Quotations will be given to inquirers who are requested to give complete data as to surface conditions and objects to be protected.

Polishing and Buffing Test Laboratory

The Industrial Equipment Division of the Continental Roll & Steel Foundry Co., East Chicago, Ind., has established a testing laboratory to make polishing and buffing time and method studies.

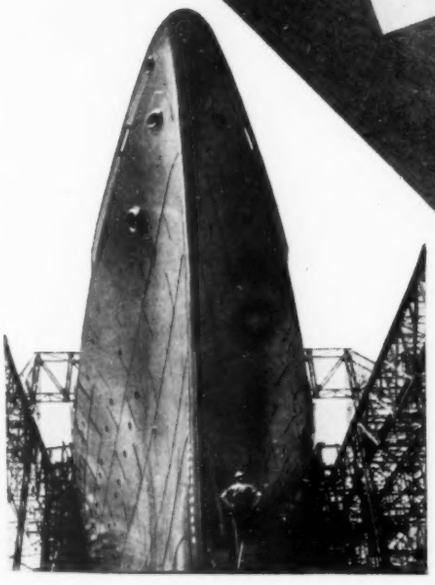
Primarily designed to determine what pieces can be effectively handled on the company's polishing and buffing machine,



Representative group of parts submitted to buffing test laboratory.

NICKEL ... THE VERSATILE ALLOYING ELEMENT

Nickel hides its might under the bustle of business. Unseen, alloyed into hard-working metals, Nickel serves in a thousand ways to increase the abilities and lengthen life of numerous types of equipment. For example, in 1890 slide fasteners were bulky, as shown at right. But 1940 Talon slide fasteners, indicated by arrow, are sleekly streamlined, compactly designed to utilize the properties of Nickel silver. Nickel silver fabricates readily, plates easily, and stoutly resists rust and corrosion.



The maiden voyage of S.S. America will be front-paged, but you probably won't read about the many special Nickel-containing alloys which make this vessel safer and more efficient. Numerous suppliers have specified Nickel alloyed materials for equipment going into the "America" because Nickel improves mechanical properties and adds service life. Revere Copper & Brass, Inc., employed 30% Nickel in 130,000 lbs. of Copper-Nickel condenser tubes installed aboard this new vessel.

. . . By a dam is another place to learn how much Nickel increases the usefulness of ferrous and nonferrous metals. Grand Coulee Dam controls a 550′ head of water with sixty 8½′ spillways. The gates on these sixty huge outlets are sealed safely and tightly with 14 tons of Nickel bronze glands, bushings and other castings. Atlas Brass Foundry, Los Angeles, added 1% Nickel to leaded "G" bronze and exceeded Federal specifications on strength and elongation. Using the right Nickel alloy may simplify your production or maintenance problems. Your consultation is cordially invited.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

and to determine what savings can be effected, the laboratory even in its short existence has made a number of worth while finds for manufacturers and plating firms. The recommendations are said to have resulted in savings in work chucking costs, more effective use of abrasive and labor.

There is no obligation on the part of the companies submitting pieces to be studied, and the data and recommendations evolved are given without charge.

The illustration shows a representative group of parts which have been submitted. Manufacturers and plating firms are invited to write for further details and to make arrangements for shipping sample parts for free laboratory tests.

Exhaust Collection Unit

The Industrial Equipment Division of the Continental Roll & Steel Foundry Co., East Chicago, Ind., introduced their new cylindrical exhaust collection unit, patent No. 2,192,515, at the Foundry Show in Chicago.

The unit is stated to be a compact, self-contained unit for collecting the exhaust dust arising from polishing and buffing wheels, grinding wheels and other dust creating machines.

These devices are said to occupy a minimum of space, less than 4 cu. ft. and

Exhaust collection unit at Foundry Show in Chicago.

effectively collect exhaust through conventional dust hoods built around the wheel or unit being ventilated. The capacity of the unit displayed is 450 c.f.m.

Exhaust is drawn into the unit by means of a specially designed vertical fan and introduced into a spiral plenum chamber for complete precipitation.

Motor is totally enclosed and sealed against dust and dirt. Collected material is removed from the unit periodically by merely loosening two wing nuts and sliding out the dust tray. Cleaned air leaves the unit through a filter which can be easily removed or replaced.

The unit is quiet in operation and because of small size and light weight, can be installed on the floor at rear of machine, suspended overhead or located in any convenient place.

Originally designed for use with polishing and buffing lathes used in conjunction with the company's semi-automatic polishing and buffing machines, these exhaust hoods are now available for use with other types of dust creating equipment.

Unique Low Voltage Generator Installation

Low voltage generators as used for electrodeposition, electroplating, electrotyping, electro-refining, etc., are by now fairly well standardized. In recent years, however, electrodeposition has broadened its field considerably, now including within its borders, the zinc coating (electrogalvanizing) of steel wire. This industry is one of the most promising users of the electrolytic method of coating metals.

1750 *H.P. synchronous motor driving* 3 *generators, each rated at* 7500 *amps.,* 36 *volts.*

Wire galvanizing differs from electrodeposition generally in a number of respects, but primarily in the scale of operations. As a part of steel manufacturing, it must necessarily operate on a huge scale and in such fashion as to fit into the production line. For that reason the engineering features of such installations are peculiar unto themselves. In no branch of electrolytic work is the equipment larger or are the operations more closely controlled than in the production of electrogalvanized wire.

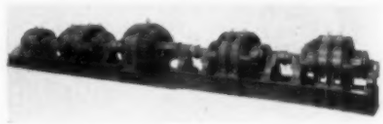
Electrical machinery for this purpose has recently been furnished by the Hanson-Van Winkle-Munning Company, Matawan, N. J., manufacturers of electroplating equipment and supplies. The equipment is so unique in character as to warrant special notice by all manufacturers who may be interested directly or indirectly in the electrodeposition of metals.

Figure 1 above illustrates one of the largest and most efficient motor generator sets ever produced for electroplating or other low voltage service. The set consists of one main driving synchronous motor coupled to three plating generators with an engine-type exciter. The motor is rated 1750 HP, unity power factor, 6600 volt, 60 cycle, 3 phase 257 R.P.M. The exciter, rated 125 K.W. 250 volt, provides excitation for the synchronous motor and the three plating generators. In addition, it furnishes D.C. power for the operation of various auxiliaries connected with the plating process.

Each of the three main plating generators is rated at 7500 amperes, 36 volts, giving a total capacity of 22,500 amperes at 36 volts. As in all modern low-voltage construction, these generators are of the double commutator type, with the two armature windings connected in parallel. In order to maintain equal division of the load between these parallel connected windings, balanced circuits are used throughout. In order to secure the highest possible overall efficiency, metal-graphite brushes are used, which is unusual for generators of this voltage. "Equaload" brushes are used to provide maximum brush life and freedom from selective action.

Figure 2 illustrates another high production installation showing 8 generating units driven by a single synchronous motor.

In complicated electrochemical processes requiring wide ranges of control of both voltage and amperage in different cells



300 *H.P. synchronous motor driving* 4 *twin generators for total of* 15,000 *amps.*

or tanks, this type of construction offers many advantages. The single motor drive simplifies the primary power supply and concentrates the problem of control and maintenance into a single unit. Four close-coupled generators on each side of the motor offer the maximum output in the minimum of floor space, with the extreme flexibility of eight separately controlled units.

In Figure 2 the synchronous motor in the center is rated at 300 H.P. unity power factor, 6600 volts, 3 phase, 60 cycles, 600 R.P.M. Excitation for the motor and generators is provided by shop current.

The generators are grouped in four twin sets (8 separate generators in all) as follows:

To the extreme left is a twin generator, each unit of which is rated at 6 volts, 1500 amperes.

Professional Directory

Any plating solution analyzed by professional chemists for only one dollar. We also sell reagent solutions at reduced prices.

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Tests, Analyses, Advisory Service.
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Electroplating Consultant
126 W. 32nd St. N. Y. C.
Telephone PEnn. 6-2214

Immediately to the left of the motor is a twin generator, each unit of which is rated at 10 volts, 3000 amperes.

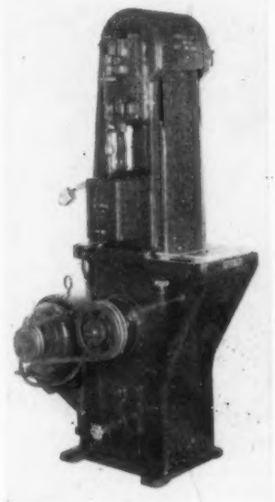
Each of the two twin units to the right of the driving motor (4 generators in all) is rated at 10 volts, 1500 amperes.

Each generating unit is of the most modern interpole construction with stabilized windings.

Heavy Duty Belt Grinders

A new heavy duty belt grinder equipped for dry or wet grinding is ready for delivery by Portable-Cable Machine Co., Syracuse, N. Y.

This new grinder, model G-8, has provisions for a variety of speeds from 2400 to 6000 F.P.M. for grinding metals, plastics, ceramics, glass, rubber, etc. Used for squaring, cleaning, burring, facing, polishing operations for removing gates and flashing.



Heavy duty belt grinder for dry or wet grinding.

An exceptionally long belt is used, 9′ in circumference. This reduces heat and the longer belt gives more economical service. Belt width 8″ or 9″. Model G-8 is built for heavy duty with large pulleys, heavy duty special sealed bearings. It is sturdily constructed throughout including the belt tensioning unit.

Low Priced Quinhydrone pH Meter

Of particular interest to those engaged in the plating and finishing of metals is the new Beckman Quinhydrone pH Meter which is being distributed by the Fisher Scientific Company of Pittsburg, Pennsylvania. The new instrument is considerably less expensive than previously available meters of this type, yet the range of its usefulness and its accuracy are quite sufficient for all pH measurements commonly made by those concerned with metal finishing.

By employing the quinhydrone and calomel electrodes, the new meter enables the operator to measure the pH of solutions within the range of pH 0 to pH 8. Because oxidizing and reducing agents react with quinone and hydroquinone, the use of Beckman Laboratory or Industrial Model Meters with glass electrodes is required when these conditions exist.

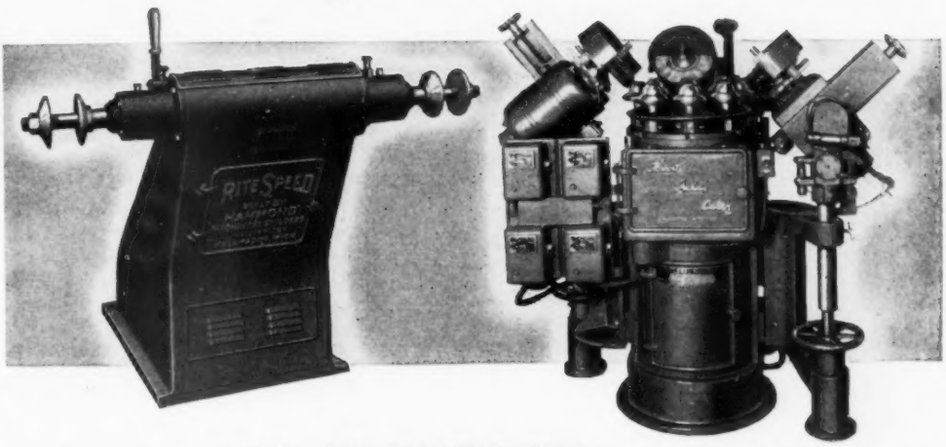
Low-priced pH meter.

The quinhydrone meter is contained in a portable fabric covered case. The electrical parts are fitted into an attractive molded black plastic case with plug-in electrode connections at the bottom. The quinhydrone electrode is of black molded plastic with a heavy solid gold insert in the tip, and the calomel reference electrode is of molded translucent plastic with a sealed-in porous plate in the bottom through which fluid contact is made.

The indicating meter is located at the top of the case and has a magnifying lens to facilitate readings which can be made to 0.1 pH. Compensations can be made for any temperature within the range of 0 to 50°C.

UP goes production

DOWN go costs . . . .



WITH HAMMOND EQUIPMENT

POLISHING LATHES
(Rite-Speed & Variable Speed)

"After using Hammond Rite-Speed Lathes one week, we are convinced we should have bought them five years ago," says a recent buyer.

Another example of the economy of modern, up-to-date Rite-Speed Lathes.

Ask for Catalog No. 10.

AUTOMATICS
(Rotary & Strait Line)

"3600 vs 250 pieces per hour and a BETTER FINISH" reports a recent buyer of a Hammond Automatic.

We may be able to do as much for you. Samples will tell—send samples for price and approximate production figures.

Investigate our line of Modern Polishing & Buffing Equipment You cannot afford to overlook a single lead that might contribute to lower finishing costs.

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STAINLESS STEEL POLISHING COMPOUNDS

Are Proven Every Day in Every Kind of a Metal Working Plant

"4-A" Polishing Compounds Are Faster, More Efficient, More Economical for Polishing, Mirror Finishing of All Kinds of Steel, Including Stainless Steel and Other Alloys.

Use it on any kind of a wheel, soft, hard, medium. Results will speak more eloquently than anything we could say.

Tell us about your toughest job, and we'll be glad to send the "4-A" product that will solve your problem. No obligation, of course.

CEMENT AND THINNER

Instead of glue, use "4-A" Cement and Thinner, a uniform substitute for polishing Wheels, Belts, Buffs, Rolls, etc.

Samples of Compound or Cement sent on request.

HARRISON & COMPANY

HAVERHILL, MASS.

New Face Shields

Announced by the Mine Safety Appliances Company is a new line of face shields for which important advantages in design and construction are claimed.

Intended for use on jobs where goggles are not absolutely required, yet protection to the face desirable, the M.S.A. face shields are said to afford comfortable protection against hot sparks, chemical splashes, flying grit and dust, etc., and are available in three models: without spark shield, with semi-spark shield and with full spark shield.

Pre-formed headgear, which conforms to the natural contours of the back of the wearer's head—as distinguished from ordinary oval "hat-band" construction—is a feature stressed by the manufacturer as is the headgear's center top strap, which supports the light weight of the shield without pressure on sides of head—the three-way, full headgear adjustment, finger control of friction adjustment permitting easy visor movement, and the aluminum binding of visor edge, which extends around the entire edge and greatly increases durability.

The visor, which may be pushed upward and back on top of the head at will, is stated to be made of the best commercially available plastic in 4", 6" and 8" sizes, in green as well as clear. Easy and inexpensive replacement of all unit parts is reported. The headgear is constructed of high quality moisture-resistant fibre, and sweatbands are genuine leather.

New face shield.

Complete details regarding the line are contained in the company's bulletin No. CE-11, copy of which may be obtained free on request to Mine Safety Appliances Company, Braddock, Thomas & Meade Sts., Pittsburgh, Pa.

Polishing and Buffing Lathe

Divine Brothers Co., Utica, N. Y., have recently introduced a new polishing and buffing lathe called type VCS. This lathe is equipped with self-aligning bearings and uses V-belt adjustment. All base castings are designed with an overhang for the spindle to facilitate handling bulky work or for placing automatic work holders in position.

Polishing and buffing lathe.

The motor is enclosed in the base for protection against dust and dirt and is easily accessible by removing a tray. Louvre doors in the side of the base provide for ventilation and further access to the motor. Available in 3, 5 and 7 H.P.

Treatment for Making Non-Conductors Conductive

A surface treatment for non-conducting materials such as phenolic products, wood, ebonite, etc., permitting such materials to be electroplated, has been developed and patented by Acheson Colloids Corporation, Port Huron, Michigan.

The treatment consists of applying a coating containing a hardenable organic colloid, a hardening agent and colloidal graphite, suspended in water, to the part by dipping, brushing or spraying, etc. The coating hardens on exposure to light

and renders the surface conductive, permitting the electrodeposition of copper, as an example.

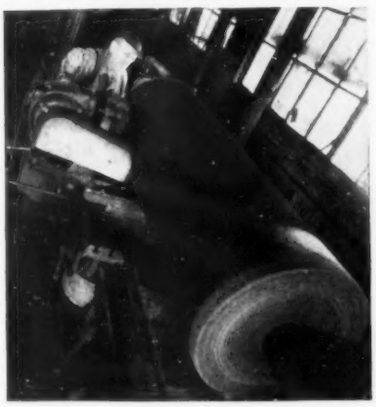
The coating is not affected by copper sulphate or cyanide solutions, and may be applied at normal or elevated temperatures (for faster drying).

The treatment may also be used directly in the preparation of electrical resistance elements by applying it to paper, for example, or for coating normally metallized surfaces of electric insulators where a certain amount of electrical conductivity is desired.

Method for Bonding Soft Rubber to Steel and Aluminum

A method for bonding soft rubber and Neoprene to steel and aluminum by hot vulcanization, has been announced by the Hewitt Rubber Corporation, Buffalo, N. Y., which is stated to give high adhesion strength between the rubber and the metal with good aging qualities.

The process embodies a chemical treatment, modifying the composition of the rubber to promote adhesion to steel, retaining its capacity to vulcanize itself to



Largest steel cylinder ever rubber covered.

the outer rubber layer, with adhesion strengths of 500-750 pounds per sq. in.

The illustration shown herewith is of the largest steel cylinder ever rubber-covered by the manufacturers.

The rubber coating protects the cylinder from acid solutions and has to withstand cutting and abrasion by the action of the steel passing over the cylinder at high speed.

Soft Rubber Polishing Wheels

The West Company, Inc., of Philadelphia, Pa., announces new developments in their line of soft rubber polishing wheels which are calculated to increase their field of application.

It is claimed that these wheels combine substantial flexibility with typical set-up wheel performance. Also the "built-in" bond eliminates costly "setting up" and balancing operations, and provides maximum efficiency due to the nature of the bond. Less than normal pressure produces desired finishes efficiently.

Wheels are easily dressed to any desired shape and hold that shape for the life of the wheel with little further attention.

To its present list of distributors, the West Company has recently added the Lea Mfg. Co. who will offer these wheels in the New England territory.

A NEW gold mine of SAVINGS has just been discovered in metal pre-cleaning! In one plant, costs have been reduced one-half, in another by two-thirds! These savings are in *dollars*, not in pennies. If you want a special job done thoroughly, swiftly and *cheaply* don't write, *wire* The J. B. Ford Sales Co., Wyandotte, Mich., for details of this new pre-cleaning method!

Wyandotte
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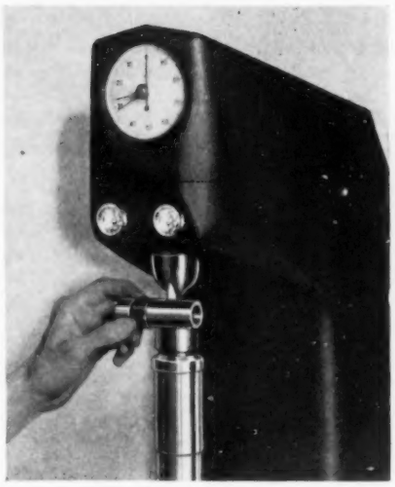
THE J·B·FORD SALES CO· WYANDOTTE MICH·

New Type Hardness Tester

A new type hardness tester known as the "Steeltest" has been introduced by the Modern Collet and Machine Company, 401 Salliotte Street, Ecorse, Mich. This instrument is particularly designed for volume hardness testing and offers automatic features never before incorporated in equipment of this nature. It can be operated at three speeds and is capable of making 1200 to 2700 accurate hardness tests per hour.

Direct readings on the "Steeltest" give actual hardness numbers in Rockwelling and Brinelling. There are no charts and no comparative readings. The readings appear on a standard 100-division dial, in



New type hardness tester.

all scales, and within the tolerance of standard test bars. The indicating dial is

In the Category of New Names

Vortexeddy

THE STORTS WAY of RINSING WITH SPRAY

also

Better Serves the Metal Finishing Industry

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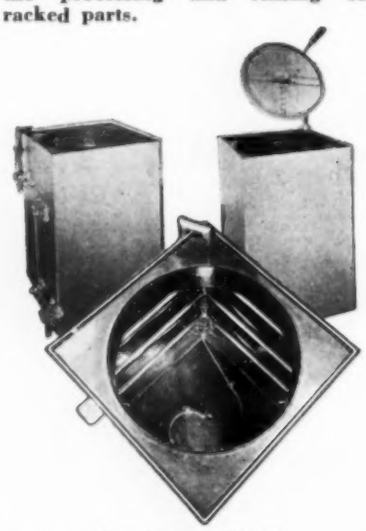
The utilitarian and functional features of Vortexeddy produce and furnish ten distinctive and different means and ways of reducing plating production costs in the processing and rinsing of racked parts.

YOU NEED IT



U.S. Patent 2,291,380

A new booklet describing HOW and WHY is yours, without obligation, for the asking. You may address us direct — or — write to your nearest Udylite Corporation Office.

●

The Udylite Corp., Chicago, Ill.
The Udylite Corp., Detroit, Mich.
The Udylite Corp., New York, N. Y.
The Udylite Corp., Cleveland, Ohio
J. C. Miller Co., Grand Rapids, Mich.
Donald Sales & Mfg. Co., Milwaukee, Wis.
L. H. Butcher Co., San Francisco, Cal.
L. H. Butcher Co., Los Angeles, Cal.
Electroplating Inc., Atlanta, Ga.
MacDermid Inc., Waterbury, Conn.
F. H. Bathke, St. Paul, Minn.

●

STORTS WELDING COMPANY
42 STONE ST. MERIDEN, CONN.

Manufacturers of Welded Fabrications and Vortexeddy Spray Rinsing Tanks.

mounted flush with the instrument, out of the feeding danger zone. It has one large black indicator and two red tolerance hands which are adjustable to the required limits.

The operation of the "Steeltest" is almost entirely automatic, the only manual operations being the hand elevation, by operation with a removable crank, for the initial setting of one specimen in each batch run and the feeding of the specimens. The travel of the penetrator is fully automatic, and is synchronized with two flasher lights located directly below the indicating dial. One flasher light is green and signals the time to feed. The other light, which is red, shows the setting to be within the range of penetrator travel. When the instrument is running idle or if the specimen is being tested improperly, the red light will appear, and can be noticed from a considerable distance.

The penetrator is encased in a housing which shields it from all possible damage. The nosepiece of the housing is designed with a guard so that the smallest parts may be tested without endangering the fingers. The exposure of the penetrator point occurs only at the time of contact with the specimen. Fluted apertures in the housing enable the operator to see the penetrator travel.

Dead weight Minor and Major loads are applied automatically and are positively constant, thus overcoming inaccuracies which arise through manual operation. Minor load is 10 kg.; interchangeable calibrated weights give Major load of 60, 100, and 150 kg.

The compensated loading beam gives a constantly equalized dead weight application through the entire stroke. There is no "pendulum swing" in the load, a most important factor in accurate application of Minor and Major loads. There are no friction burdened push-rods or cumbersome auxiliary lifts in the loading mechanism.

The power supply is 1/15 h.p. Ratiomotor, 60 cycles, 110 volt a.c., arranged with a direct coupled cam drive.

New Tin-Lead Alloy Plating Bath

The Zialite Corp., 143 Exchange St., Worcester, Mass., have announced the development of a new bath for plating a tin-lead alloy.

The deposits obtained are said to be corrosion resistant and cheaper than cadmium and are ideal for parts which must be soldered. The solution is operated at room temperature with current densities up to 50 amps. per sq. ft. The cathode efficiency is stated to be 100%, and the bath, according to the manufacturer, is simple to control and easy to operate.

Small parts ready for plating, sent to the Zialite Corporation, will be finished with the new tin-lead alloy deposit.

Manufacturers' Literature

Aluminum Alloy. A 4-page illustrated folder has been issued by the National Bronze & Aluminum Fdy. Co., East 88th & Laisy Ave., Cleveland, Ohio, describing their T-1 aluminum alloy. The characteristics of this alloy are high tensile strength without heat treatment, easy machineability and ability to take a weld without loss of physical properties. Physical data are also given.

Cadmium Plating. E. I. duPont de Nemours & Co., Electroplating Division, Wilmington, Dela., describe their cadmium plating bath "Cadalyte" in a new 10-page book. Information on the preparation of solution, control, method of analysis and other pertinent information are given. A valuable chart on electrochemical equivalents and deposition rates is included.

Electrical Contacts. "Silver Nickel Contacts" is the title of a 4-page folder of the Gibson Electric Co., Pittsburgh, Pa., describing their mechanical and electrical characteristics. The various applications of these contacts are given and drawings illustrate various types of construction.

Copper Coating. A new process called "Cuprodine" is described in a 4-page folder recently issued by the American Chemical Paint Co., Ambler, Pa. These salts are dissolved in water with the addition of sulfuric acid and are used to deposit an adherent film of copper by simple immersion. Descriptions of other ACP products are also given.

Filters. T. Shriver & Co., 810 Hamilton St., Harrison, N. J., illustrate and describe their various filters for the plating industry in an 8-page folder recently issued. Reasons for filtration and methods of filtration are considered. Information is also presented on how to select the proper filter.

Fatty Acids. "Liqro & Indusoil" is the title of a booklet published by Industrial Chemical Sales Div., West Virginia

Pulp & Paper Co., 230 Park Ave., New York City, describing new organic acids of resinate and oleate type for industrial use. Specifications and chemistry of the products are given. Applications of these fatty acids for various uses, such as metal cleaning, for emulsions, cutting oils and other purposes are described.

Polishing Cement. J. J. Siefen Co., 1936 W Lafayette Blvd., Detroit, Mich., illustrate the proper use of their polishing cement called "Nuglu" in three illustrations incorporated in a recent release. The equipment for applying the adhesive and its use are illustrated as well as methods for drying the wheels after being set up.

Safety Clothing. Industrial Gloves Co., 900 Garfield Blvd., Danville, Ill., have recently published their 1940 catalog describing safety clothing for industry. Equipment for the protection of all parts of the body, in many types of industry, are illustrated and described.

Thermostats. "G-E Thermostats for Use with Midget Heating Units" are described in a recent folder of the General Electric Co., Schenectady, N. Y. The integral parts of these thermostats are illustrated and described together with tables for the proper selection of the thermostats for the job concerned.

New Books

Electrochemical Theory. By Dr. Henry J. S. Sand. Published by Chemical Publishing Co., New York. Size 7½" x 5"; 130 pages. Price $2.00.

This book is a theoretical and practical treatise for students and analysts of the electrochemical theories. A small amount of mathematical treatment is given and the book should be understandable to those with elementary calculus. The ionic theory, conduction, activity, electrode potentials and irreversible electrolytic processes, are among the subject matter discussed.

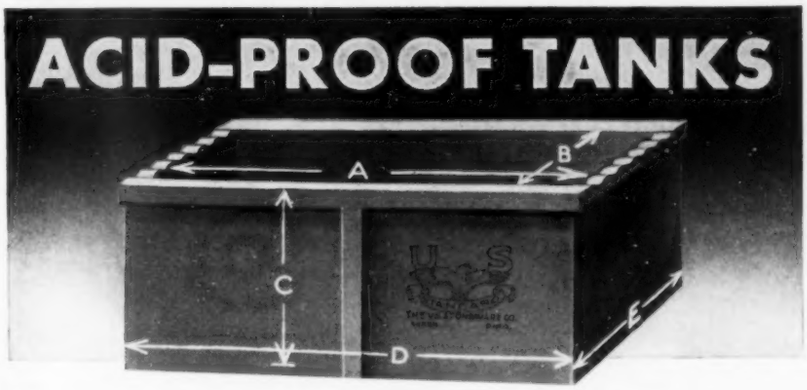
Machine Shop Training Course. By Franklin D. Jones. First Edition. Published by Industrial Press, New York City. Size 9" x 6"; 538 pages. Price: Volume I and II together $6.00; either volume separately, $4.00.

These are very practical and valuable volumes on principles of machine shop work. The book is clearly printed in a catechism style and should prove to be an excellent text for the beginners in machine shop work.

The volumes are sufficiently comprehensive to also be of value to those experienced in machine shop work. Fundamental principles, methods of adjusting and using different types of machine tools, measuring instruments and gages are thoroughly described.

Typical shop problems with solutions and miscellaneous facts relating to the art of machine construction are included.

ACID-PROOF TANKS



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41	24	20	20	66.00
44	32	20	16	78.00
66	32	24	20	96.00
69	40	20	20	104.00
104	36	28	24	140.00
119	48	24	24	152.00
149	60	24	24	206.00
210	48	32	32	248.00
320	72	32	32	360.00

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CORROSION-RESISTING TANK LININGS for:

- Pickling Tanks for stainless-steel
- Plating Tanks for bright nickel, copper, etc.
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THE U. S. STONEWARE CO.
WORKS (SINCE 1865) AKRON OHIO

A Dictionary of Metals and Their Alloys. Edited by F. J. Camm. Published by Chemical Publishing Co., New York. Size 8¾" x 5¾"; 245 pages. Price $3.00.

This book contains descriptions of metals and their alloys, giving their physical characteristics and arranged alphabetically. The book is well cross-referenced and occasional historical facts are given.

The book is not as complete as the valuable work "Engineering Alloys" by Woldman and Dornblatt. However, it contains mention of alloys developed since the publication of that book in 1936.

Much superficial, and to this reviewer, out of place discussions, are given on electroplating, hardening and tempering, metal spraying, rust-proofing, etc., which do not detract from the value of the book as a dictionary, but add little to the book as a source of good information on these subjects.

Associations and Societies

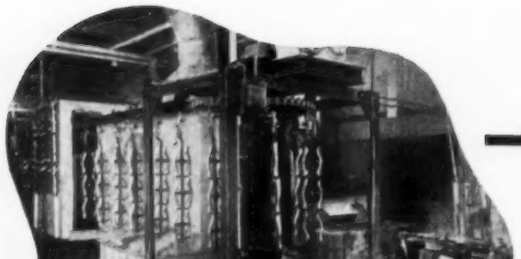
American Society for Testing Materials

The Society's 43rd Annual Meeting To Be Held In Atlantic City, N. J., June 24-28

The meeting will be held at the Chalfonte-Haddon Hall, with twenty-two separate sessions and several symposiums. The symposiums cover:

Tools of Analytical Chemistry

Spectrochemical Analysis



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METSO CLEANERS keep step with speed production holding rejects at a minimum. The reason rests in the able-bodied alkalinity in Metso which is balanced with silica. This combination lifts the grease, leaving metal parts *chemically* clean.

Metso is so thorough that one large plater, formerly copper plating before nickel, on steel, eliminated the copper, and had a better plate directly with nickel.

Put Metso to work on your particular problem. Further information without obligation.

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Chromium Plating Tank

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STEEL COILS—LEAD COILS
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ELECTRIC IMMERSION UNITS
GAS UNITS

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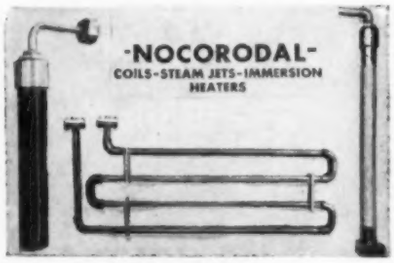

HEIL AND COMPANY
3088 W. 106 ST. CLEVELAND, O.

Problems in the Classification of Natural Water Intended for Industrial Use
Tension Testing
Radiographic Testing

In addition, separate sessions will be held on testing methods, corrosion, cement and concrete, non-ferrous metals, plastics, electrical insulation and rubber.

American Electroplaters' Society

Detroit Branch

Walter L. Pinner, president of the Branch, will speak at the meeting to be held on June 7th.

Newark Branch

The chief speakers will be *George Reuter* of the American Can Company, Newark, who, on June 7th, will give a "Report of the Chemistry Class," and *Robert Sizelove* of the Frederick Gumm Chemical Co., Kearny, N. J., who will address the Branch on June 21st, the subject of his talk being "Trouble Shooting."

New York Branch

On Friday evening May 10th, *Paul Oldam* of E. Poeter & Co., Inc., Irvington, N. J., addressed the Branch, the subject of his talk being "The Electrodeposition of Gold and Its Alloys."

The second meeting of the month was a Question Box, with a general discussion on plating problems.

Los Angeles Branch

Installation of the 1940-1941 officers took place at the May 8th meeting, with *Earl Coffin*, master of ceremonies.

Inducted into office were *Don Bedwell*, president; *Frank Rushton*, vice-president; *Ervin Frauenhof*, secretary-treasurer, and *Emmette R. Holman*, librarian. Sergeant-at-arms *Carl C. McClaren* was absent due to an attack of influenza which had confined him to his home for several days.

Retiring president, *Ray Bray*, was given a fountain pen and pencil set in token of esteem and appreciation for a job well done. Thanks were also extended to *Ray Solivan*, who served as secretary-treasurer.

A report by *Ernest Lamoureux*, showed that the chapter had 56 members.

Bryce A. Denton and *Gilbert John Extel* of the General Electric Company, Ontario, Calif., were elected to membership.

The educational program of the meeting was highlighted by a motion picture, "Wonder World of Chemistry," presented by *D. N. Eldred* on behalf of E. I. duPont de Nemours & Co., Inc.

Letters From Our Readers

New Method of Metallization

Editor, METAL INDUSTRY:

Please permit a modern metallizer to correct both of your correspondents and Re-Shore them that they are a little behind the times. This might be a secret although the writer has never tried to keep it as such.

For the past six years, we have been metallizing various objects, and some of them mighty delicate, by submerging them in molten stearic acid for a few minutes, spraying them with bakelite lacquer and at once covering with the very thinnest copper or gold foil obtainable, i.e., gold leaf or copper leaf, such as is used by store window sign painters.

Be certain that the leaf metal is not aluminum as that metal can be bought in all colors but will not do, as you cannot plate on this dyed aluminum foil. This method is faster and produces a smoother deposit. If you do not know how to apply foil, get your instructions from a sign painter or the people who sell gold leaf and the proper brush for applying it.

Yours truly,
Carl Treuleben,
Linick, Green & Reed, Inc.,
Chicago, Ill.

* * *

Carl Treuleben,
Linick, Green & Reed, Inc.,
Chicago, Ill.

Dear Sir:

Your letter of April 9th regarding metallizing non-metallics is quite interesting. Unfortunately, we overlooked publishing this letter in the May issue, and will, therefore, hold it over until the June issue.

On the surface, your method would seem to be good for rather simple objects, but we would like to know whether it can be used for metallizing complicated shapes; for example, baby shoes.

Very truly yours,
Walter R. Meyer,
Editor.

* * *

Dear Dr. Meyer:

In reply to your letter of May 8th, of course, baby shoes are the commonest of articles that have been metallized regularly, and we have processed without the slightest trouble such articles as: bugs, mice, insects, butterflies, catalin articles for use as jewelry, novelty jewelry and novelties made of wood, plaster casts in imitation of ivory carvings covered with silver and left in their natural ivory-like finish as they come from the bath, lacquered with bakelite lacquer; feathers, flowers, turtles complete and shells, scallop shells and numerous other articles; coins and other articles of aluminum display signs and both photographic negatives and positives, also transparencies, galalith knife handles, antlers and hoofs and a variety of museum articles—all for display.

All articles were invariably plated with copper first, then usually followed by a nickel strike and eventually with such metals as silver, gold, tin, rhodium, molybdenum, bright nickel and cadmium. For duplicating, we plate with tantalum and occasionally with chromium as these metals are separable without the use of resists, leaving the finest of depressions or lines as nearly perfect as the original. Molds for casting high tin alloys thus leave a perfect surface for such articles as novelty jewelry and the like.

Yours truly,
Carl Treuleben,
Linick, Green & Reed, Inc.,
Chicago, Ill.

Step Up Production!

STEP DOWN Polishing and Buffing COSTS!

Here's How to Do It!

Take advantage of the speed and economy made possible by an Acme Automatic, increasing your production and, at the same time, decreasing your unit cost. Let us show you how an Acme Automatic can be adapted to meet your individual problem of polishing and buffing. If your production is lagging, our engineering staff will be glad to study your requirements and make a recommendation without charge or obligation.

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Builders OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR OVER 25 YEARS

Cleans Nickel "BEFORE" Chrome

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"B-4 CHROME" CLEANER

Eliminates Buffing After Chrome Plating

(Let's Fly to Dayton, A.E.S. Convention, June 10-11-12-13)

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(Samples?—Sure)

Clean off Those Buffing and Polishing Compounds--

Thoroughly and Cheaply

The one sure way to insure better finishes and fewer rejects due to spotting out, pitting or bad bonding is to make sure of a good precleaning job. Tripoli, crocus and other buffing and polishing compounds need the right kind of cleaner. You can spend plenty in time and money, without getting real results—or you can do the job at mighty low cost and with assured results, if you

ASK FOR PERFORMANCE REPORTS

on Magnus 7 and 76 as well as other special cleaners for metal finishing operations, sent us by users who describe the results they are now getting, compared with previous methods.

USE MAGNUS 7 or 76

For aluminum, there is no more effective cleaner than Magnus 7.

For other metals, Magnus 76 is the answer.

They both emulsify the greases and waxes in polishing compounds, disperse the abrasives and fine metal particles on the metal surface. Both rinse off quickly and completely to give a bright, film-free surface.

If you want low costs and insured quality of finish, give these two Magnus special cleaners a thorough trial.

MAGNUS CHEMICAL COMPANY

Manufacturers of Cleaning Materials, Industrial Soaps, Metallic Soaps, Sulfonated Oils, Emulsifying Agents and Metal Working Lubricants.

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Nickel, Chlorides
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COPPER SOLUTIONS
Copper, Free Cyanide
Carbonates, pH

ACID COPPER
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Personals

Samuel L. Cole Becomes Sales Manager of Chas. F. L'Hommedieu & Sons Company

Chas. F. L'Hommedieu & Sons Company of Chicago announce the appointment of *Samuel L. Cole*, familiarly known as "Sam", as General Sales Manager, having direction of sales in the Main Office at Chicago, Branches at Cleveland and Los Angeles and representatives in Detroit, Philadelphia and Bloomingdale, New Jersey. Mr. Cole has been with the Chas. F. L'Hommedieu & Sons Company for twenty years and is well known in this

Samuel L. Cole

industry. We wish to congratulate Mr. Cole upon his new duties as General Sales Manager of this old established house. He has our best wishes for continued success.

G. H. Niemeyer Forty Years with Handy & Harman

At a luncheon in the Drug & Chemical Club, New York, Handy & Harman paid tribute to their president, *G. H. Niemeyer*, who on May 1st celebrated his 40th anniversary with the company. The luncheon was attended by 26 members of the Handy & Harman organization including company officers, heads of departments and senior salesmen. *C. W. Handy*, chairman of the board of directors, speaking for the officers, presented Mr. Niemeyer with a handsome silver and onyx desk clock to commemorate the occasion.

Though still young, Mr. Niemeyer is the oldest member of the Handy & Harman organization in years of service, although there are a number of others who are close to the 40-year mark and many who have been with the company 20 years or more.

Mr. Niemeyer's associates and friends are hoping that he will continue for a long time to come to lead the affairs of Handy & Harman and serve the industry as a whole as he has in the past.

A. P. Munning of the Hanson-Van Winkle-Munning Co., Matawan, N. J., was recently elected President of the Matawan Bank, Matawan, N. J.

Business Items

Beam-Knodel Co., 195 Lafayette St., New York, have been appointed Metropolitan representatives for Maizo Mills, Inc., Circleville, Ohio, manufacturers of drying materials, to replace sawdust.

The Udylite Corporation, Detroit, Michigan, manufacturers of electroplating and polishing equipment and supplies, announces the removal of its Eastern district office from 30 East 42nd Street to 60 East 42nd Street, New York City. *A. B. Hoefer* is eastern district manager.

Wilfred S. McKeon, president of Sulphur Products Co., Greensburg, Pa., has announced the addition of *Paul Revere Mogle* to the staff of the company. Mr. Mogle will be a full-time representative in the south, and at the moment is in the Carolinas, selling the company's sulphur oxidizing agent, copper stripping agent and a cleaner for use previous to chromium plating.

E. F. Houghton Co. Honors Employees

In honor of its 75th Anniversary, gold service emblems have been presented to employees of E. F. Houghton & Co., oil, leather and metal-working products, Philadelphia.

A total of 324 men and 77 women having long served that company were given these emblems by Major A. E. Carpenter, President. Of these, 110 men and 39 women have been employed from 10 to 20 years; 30 men and 15 women from 20 to 30 years, and several for more than 30 years.

E. F. Houghton & Co., started in business in 1865 as a pioneer in the commercial uses of petroleum, and rapidly advanced into metal working, having been credited with producing the first commercial carburizer to replace raw bone.

Its service to the metal industry includes research publications such as "Steel and Its Treatment," "Practical Metallurgy for Engineers" (still used as a textbook in many universities)—as well as development and perfection of scientific substitutes for staples, such as modern quenching oils for fish oils, and sulphurized cutting oils to replace lard oils.

The perfection of liquid salt baths for heat treatment, the origination and development of liquid carburizers, and more recently an anti-piping compound to increase ingot yield in steel making, are examples of the company's contributions to the metal industry. Branch plants are now located in Chicago, Detroit, Toronto and Birmingham, England (and other foreign plants excepting Germany).

"PLATING RACKS STILL PERFECT

AFTER 6 MONTHS' SERVICE!"

WRITES

UNICHROME* RACK COATING-W

USER

Read his enthusiastic report. You want to save money by getting longer life from your plating rack coating. So read what this user of "Unichrome" Rack Coating-W says . . .

"One set of racks coated with your Rack Coating-W is in use in the cleaning and bright nickel cycle; the other in cleaning and chromium plating. They're still in perfect condition (after 6 months' service). It's the best material on the market."

From many other letters in our files come comment after comment—like "the finest material we've come across". For in "Unichrome" Rack Coating-W users find a coating material with a *combination* of advantages found in no other rack insulation . . .

1. Not affected by boiling cleaners or plating solutions
2. Does not blister or crack
3. Tough—withstands wear and tear of normal handling
4. Contains no ingredient harmful to any plating solution
5. Cuts costs—by greatly reducing frequency of recoatings
6. Easy to apply—by "dip and force-dry" method
7. White in color—easy to see how completely the rack is covered
8. Any part of rack can be recoated without necessity of recoating entire rack.

Write for Bulletin No. 27
Containing complete information

Platers without rack dipping and drying facilities may have their racks coated with "Unichrome" Rack Coating-W by making arrangements with Chromium Corporation of America, 4645 West Chicago Avenue, Chicago, Illinois; Lea Manufacturing Company, Waterbury, Conn., or Belke Mfg. Company, 747 N. Cicero Avenue, Chicago, Illinois.

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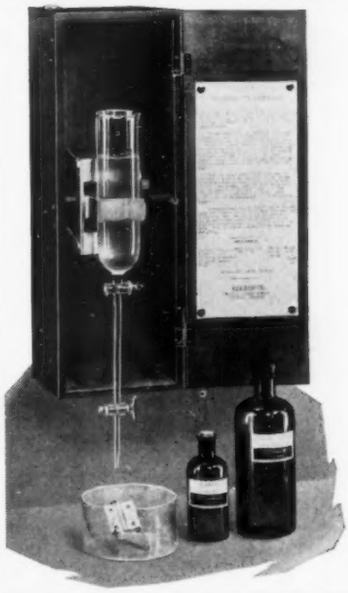

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Hull & Strausser Method

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Oakite's Detroit and Chicago Divisions Meet

Forty-six field service representatives from ten different States comprising the Detroit and Midwestern and Chicago and Southwestern divisions of Oakite Products, Inc., recently held their regular Annual Technical Sales Conference at the Lake Shore Athletic Club in Chicago.

Discussions during the two-day conference revealed the fact that in view of the greatly increased activity of metal-working plants throughout the country, part of which is attributed to educational orders being placed by the Government, production executives are showing increased interest in newly developed cleaning materials and methods which help to speed-up production.

Air Associates, Inc., Roosevelt Field, Garden City, N. Y., recently announced that the company would probably locate its new factory in New Jersey as soon as a suitable site can be selected and a factory and office building erected.

Schwartz Mfg. Co., Two Rivers, Wisc., buffing wheels and other products, will begin work soon on a one-story addition, 180 x 200 ft. Cost over $65,000 with equipment.

Colonel A. L. Mercer, president and *H. L. Trembicki*, manager of the Metal Cleaner Department of the Cowles Detergent Company announce the appointment of *George P. Needham* as Cowles metal cleaner representative in the Ohio territory. Mr. Needham is well known in this territory as he has been contacting industrial accounts, throughout the state for the past several years, and is well qualified in both knowledge and experience. Mr. Needham will work out of the main office of the company, in Cleveland, Ohio.

C. G. Hussey & Co., Pittsburgh, Pa., have announced the production of cast copper anodes in addition to their rolled anodes. The new cast anodes are available, in any size or shape, through seven of the company's warehouses, located throughout the country.

Monarch Cutlery Mfg. Co., 411—24th St., Guttenberg, N. J., has let general contract for a new one-story plant, about 75 x 100 ft., at North Bergen, N. J. Cost close to $45,000 with equipment. The following departments are operated: stamping, welding, plating, vitreous enameling, grinding, polishing, buffing, barrel burnishing, tumbling, descaling, pickling, cleaning (alkaline), degreasing (solvent), lacquering. Principal base metal used: steel.

Harold E. Trent Co., announces the removal of their offices and plant from 618-40 N. 54th Street to larger quarters at 55th Street and Wyalusing Ave., Philadelphia, Pa.

Despatch Oven Co., Minneapolis, Minn., have announced the appointment of *P. L. Capy* of Dallas, as district engineer in the state of Texas. Mr. Capy's appointment represents the establishment of the twenty-second sales office of this company.

L. V. Nagle Elected Udylite Vice President

At the annual Director's and Stock Holder's meeting of the Udylite Corporation, Detroit, Michigan, manufacturers of electroplating and polishing equipment and supplies, the Directors of the Corporation elected *Lawrence V. Nagle*, Vice President. Other officials reelected are as follows:

Charles Awkerman—Board Chairman
L. K. Lindahl—President
C. H. Reeme—Vice President and Treasurer
Horace S. Maynard—Secretary
A. L. Barak—Assistant Treasurer
John C. Moons—Assistant Secretary

Lawrence V. Nagle

Mr. Nagle graduated from the Commerce and Finance Department of the University of Detroit in 1926. He joined the Udylite Corporation in 1932 after having been associated with several firms in a selling capacity. In 1937 he was appointed District Sales Manager of the Detroit area. Mr. Nagle will continue to direct sales in the Detroit district for the Udylite Corporation.

The Zialite Corp., Mt. Vernon, N. Y., announce that they are moving to larger quarters at 143 Exchange Street, Worcester, Mass., on June 10. This move is being made so that the company may take better advantage of the services of their technical director, *Dr. Ernest D. Wilson*, who was recently appointed Head of the Department of Chemical Engineering and Chemistry of the Worcester Polytechnic Institute.

The company reports that its sale of its nickel plating solution for the direct nickeling of zinc and aluminum die castings has been increasing, with April being the largest month in the company's history. The company has also announced a new tin-lead solution called "Stan-O-Lead", which is described in the New Supplies and Equipment section.

Flush Metal Partition Corp., 22-14—40th Ave., L. I. City, N. Y., metal products, has purchased a two-story building at 46-10—11th St., on a site 100 x 100 ft., with adjoining tract, for plant, expanding present capacity. The following departments are operated: stamping, soft soldering, brazing, welding, grinding, polishing, buffing, enameling. Principal base metals used: steel, copper, brass, bronze, aluminum, nickel silver and lead.

MADE FROM PURE LAKE COPPER
Any Size or Shape

Deposits more quickly and smoothly... goes into solution faster . . . speeds up your operations . . . scrap losses are practically nil.

Order a supply from your nearest Hussey Warehouse.

C. G. HUSSEY & CO.
(Division of Copper Range Co.)
Rolling Mills and General Offices: Pittsburgh, Pa.
Warehouses in Principal Cities

ATTEND
AMERICAN ELECTROPLATERS' SOCIETY
ANNUAL CONVENTION
Dayton, Ohio — June 10-14

- 25 technical papers
- Plant visits
- Meet the outstanding men in electroplating

THE WILLIAMSVILLE BUFF MFG. CO. TRADE MARK EST. A1 1893 DANIELSON CONN.

"A1"

MAGIC letters are these in Dun and Bradstreet, and they're equally assuring on a buff wheel. Since 1893 our buffs have been known by the A1 trademark, assurance of quality and workmanship.

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PERMAG Cleaning Compounds Solves the hard metal cleaning Problems 100 per cent

When a tough metal cleaning job comes along that looks impossible, let PERMAG go to work on it.

PERMAG cleans quickly, thoroughly, efficiently and at low cost.

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GET EXTRA THROWING POWER!

With Single or Double MULTI-EDGE Anodes

Hundreds of important plants from coast to coast are using and *reordering* Single and Double MULTI-EDGE Anodes! Many chrome platers are standardizing on them. And no wonder! These superior anodes are made by a firm that specializes in homogeneous lead coatings . . . that never tolerates any molding or casting processes!

The homogeneous bond assures 100% contact between hook and anode, giving absolute conductivity.

Another big point to remember is that every MULTI-EDGE Anode is stenciled to show the solution level which should be maintained.

Order from your supply house or write direct to

REPUBLIC LEAD EQUIPMENT CO.

L. R. SCHLUNDT
Manager

7928 Jones Rd. Cleveland, Ohio

SAVE MONEY! MODERNIZE YOUR PLANT BY MAKING A SMALL INVESTMENT!

Lupomatic equipment is very inexpensively priced. The process is fully automatic. Equipment costing less than $200.00 produces a job that cannot be duplicated by automatic polishing machines costing from $15,000.00 to $20,000.00.

Progressive manufacturers are now using the LUPOMATIC process to compete and to meet the strict requirements of the trade. LUPOMATIC equipment operates fully twenty four hours a day.

Save and produce automatically the finest finish at the lowest cost!

LUPOMATIC TUMBLING MACHINE CO., INC.

4510 Bullard Ave. New York, N. Y.

FAirbanks 4-1870

American Smelting and Refining Co., 120 Broadway, New York, have offered for sale indium metal which is available in substantial quantities at a price of $15 per avoirdupois ounce for a product running 99% plus in purity. New methods of production and new sources have enabled the marked price reduction. Indium is being used in bearings to inhibit oil corrosion.

Eis Mfg. Co., Middletown, Conn., automotive parts manufacturer, has begun operations. *Ernest Schwartz*, president, has announced that about 75 men will be added to the payroll soon. Departments: rolling, stamping, tumbling, degreasing (solvent), lacquering and painting. Principal base metals used are steel and copper.

Wiremold Co., Hartford, Conn., wiring equipment manufacturer, has begun work on a 27,000-sq. ft. plant addition. Building will provide expanded facilities for production of fluorescent lighting equipment. Departments: rolling, drawing, stamping, welding, enameling. Principal base metals used are steel and aluminum.

R-S Products Corp., Philadelphia, Pa., announces that *W. E. Borbonus* has replaced *F. J. Ryan* as president and *D. E. Wyman* is the new vice-president and chief engineer. He was formerly chief engineer of the Industrial Furnace Div. of the Philadelphia Drying Machinery Company.

Noblitt-Sparks Industries, Inc., Seventeenth Street, Columbus, Ind., radio equipment and parts, automobile heaters, etc., plans two one-story additions, for expansion in metal-stamping division and for storage and distribution respectively. Cost over $65,000 with equipment, work to be carried out during summer. The following departments will be operated: drawing, stamping, soft soldering, welding, plating, hot tinning, grinding, polishing, buffing, barrel burnishing, tumbling, cleaning (alkaline), enameling, and painting. Principal base metals to be used: steel, copper, brass, zinc, and lead.

Barnard Aviation Equipment Co., Inc., 6 Dawson St., Newark, N. J., aircraft parts and accessories, has acquired former mill of West Knitting Mills, Ashley, Pa., comprising two one-story units, and will remodel and remove present works to new location, increasing capacity. Departments: rolling, drawing, stamping, soft soldering, hard soldering, brazing, welding, plating, sand blasting, grinding, polishing, painting. Principal base metals used: steel, copper, brass, bronze, aluminum.

Brochsteins, Inc., 3400 Washington St., Houston, Texas, bank and store fixtures and equipment, has let general contract for a new one-story plant, 105 x 380 ft. on Main St. extension, near city limits. It will replace a plant recently destroyed by fire. Cost about $120,000 with equipment. Departments: soft soldering, hard soldering, brazing, welding, grinding, polishing, buffing, barrel burnishing. Principal base metals used: steel, copper, brass, bronze, aluminum.

Supply Prices, May 27, 1940

Anodes

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 2,000 lbs. or more, and subject to changes due to fluctuating metal markets.

COPPER:	Cast	21⅝c. per lb.	
	Electrolytic, full size, 16⅝c.; cut to size	16⅝c. per lb.	
	Rolled oval, straight, 17⅛c.; curved	18⅛c. per lb.	
BRASS:	Cast	18½c. per lb.	
ZINC:	Cast	11 c. per lb.	
NICKEL:	90-92%, 16″ and over	.45 per lb.	
	95-97%, 16″ " "	.46 per lb.	
	99%+cast, 16″ and over, 47c.; rolled, depolarized, 16″ and over, 48c.		
SILVER:	Rolled silver anodes .999 fine were quoted from 38c. per Troy ounce upward, depending on quantity.		

Chemicals

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone, Pure, l.c.l., drums	lb.	.08
Acid, Boric (boracic) granular, 99.5%, bbls.	lb.	.053-.059
Chromic, 99%, 100 lb. and 400 lb. drums	lb.	.16¾-.17¼
Hydrochloric (muriatic) Tech., 20°, carboys	lb.	.027
Hydrochloric, C.P., 20°, carboys	lb.	.08
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36°, carboys	lb.	.06
Nitric, 42°, carboys	lb.	.075
Oleic (Red Oil), distilled, drums	lb.	.075-.085
Oxalic, bbls. l.c.l.	lb.	.12-.14
Stearic, double pressed, distilled, bags	lb.	.10½-.11½
single pressed, distilled, bags	lb.	.10-.11
triple pressed, distilled, bags	lb.	.13¼-.14¼
Sulphuric, 66°, carboys	lb.	.025
Alcohol, Amyl, (Fusel oil, ref'd), l.c.l., drums	lb.	.175
Butyl-normal, l.c.l., drums	lb.	.095-.105
Denat., S.D. #1, 190 pf., 1-18 drms, wks.	gal.	.335
Diacetone, pure, drums, l.c.l.	lb.	.10
Methyl, (Methanol), 95%, drums, l.c.l.	gal.	.36-.38
Propyl-Iso, 99%, l.c.l., drums	gal.	.41
Propyl-Normal, drums	gal.	.70
Alum, ammonia, granular, bbls., works	lb.	.035
Potash, granular, bbls., works	lb.	.0375
Ammonia, aqua, 26°, drums, carboys	lb.	.02½-.05¼
Ammonium, chloride (sal-ammoniac), white, granular, bbls.	lb.	.0521-.075
Sulphate, tech., bbls.	lb.	.035-.05
Sulphocyanide (thiocyanate), pure, crystal, kegs	lb.	scarce
Sulphocyanide (thiocyanate), com'l, drums	lb.	"
Antimony Chloride (butter of antimony), sol., carboys	lb.	.17
Barium Carbonate, ppted., l.c.l., bags, works	lb.	.03
Benzene (Benzol), pure, drums, works	gal.	.21
Butyl Lactate, drums	lb.	.235
Cadmium Oxide, l.c.l., bbls	lb.	.85
Calcium Carbonate (Ppted. chalk), U.S.P.	lb.	.05¾-.075
Carbon Bisulfide, l.c.l., 55 gal. drums	lb.	.05¾-.06
Carbon Tetrachloride, l.c.l., drums	gal.	.73
Chrome, green, commercial, bbls.	lb.	.21
Chromic Sulphate, drums	lb.	.26¼
Cobalt Sulphate, drums	lb.	.65
*Copper, Acetate (verdigris), bbls.	lb.	.25
Carbonate, 53/55%, bbls.	lb.	.16-.17¼
Cyanide, Tech., 100 lb. bbls.	lb.	.34
Sulphate, Tech., crystals, bbls.	lb.	.051
Cream of Tartar (potassium bitartrate), gran., bbls.	lb.	.31¼
Crocus Martis (iron oxide) red, tech., kegs	lb.	.07
Dibutyl Phthalate, l.c.l., drums	lb.	.195
Diethylene Glycol, l.c.l., drums, works	lb.	.155
Dextrine, yellow, kegs	lb.	.05-.08
Emery Flour (Turkish)	lb.	.07
Ethyl Acetate, 85%, l.c.l., drums	lb.	.075-.085
Ethylene Glycol, l.c.l., drums, works	lb.	.17-.20
Flint, powdered	ton	30.00
Fluorspar No. 1 ground, 97-98%.	ton	$60.00
Fusel Oil, refined, drums	lb.	.125-.14
*Gold, Chloride	oz.	$18¼-23
Cyanide, potassium 41%	oz.	$15.45
Cyanide, sodium 46%	oz.	$17.10
Gum, Arabic, white, powder, bbls.	lb.	.125-.14
Sandarac, prime, bags	lb.	.50
Hydrogen Peroxide, 100 volume, carboys	lb.	.20
Iron Sulphate (Copperas), bbls.	lb.	.017
Lead, Acetate (Sugar of Lead), bbls.	lb.	.11-.13¾
Oxide (Litharge), bbls.	lb.	.125
Magnesium Sulphate (Epsom Salts), tech., bag	lb.	.018
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Mercuric Oxide, red, powder, drums	lb.	$3.06
Nickel, Carbonate, dry, bbls.	lb.	.36-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.135-.145
Salts, double, 425 lb. bbls.	lb.	.135-.145
Paraffin	lb.	.05-.06
Perchlorethylene, drums	lb.	.08½
Phosphorus, red, cases	lb.	.42
yellow, cases	lb.	.40
Potash, Caustic, 88-92%, flake, drums, works	lb.	.07¼-.075
Potassium, Bichromate, crystals, casks	lb.	.09¼
Carbonate (potash) 98-100%, drums	lb.	.06¾
Cyanide, 94-96%, cases	lb.	scarce
Pumice, ground, bbls.	lb.	.03
Quartz, powdered	ton	$30.00
Quicksilver (Mercury) 76 lb. flasks	flask	$90.00
Rochelle Salts, crystals, bbls.	lb.	.24¼
Rosin, gum, bbls.	lb.	5.25-7.75
*Silver, Chloride, dry, 100 oz. lots	oz.	.32
Cyanide, 100 oz. lots	oz.	.33½
Nitrate, 100 oz. lots	oz.	.27
Sodium, Carbonate (soda ash), 58%, bbls.	lb.	.0235
Cyanide 96%, 100 lb. drums	lb.	.15
Hydroxide (caustic soda) 76%, flake	lb.	.0355
Hyposulphite, crystals, bbls.	lb.	.035-.065
Metasilicate, granular, bbls.	lb.	.0335
Nitrate, tech., bbls.	lb.	.029
Phosphate, tribasic, tech., bbls.	lb.	.0295
Pyrophosphate, anhydrous, bbls., l.c.l.	lb.	.0580
Sesquisilicate, drums	lb.	.0425
*Stannate, drums	lb.	.35-.37
Sulphate (Glauber's Salts), crystals, bbls., works	lb.	.0135
Sulphocyanide, drums	lb.	.30-.35
Sulphur, Flowers, bbls., works	lb.	.037-.0410
*Tin Chloride, 100 lb. kegs	lb.	.40½
Toluene (Toluol), pure, drums, works	gal.	.30
Trichlorethylene, drums	lb.	.08½
Tripoli, powdered	lb.	.03
Wax, Bees, white, bleached, slabs 500 lbs.	lb.	.38-.40
Bees, yellow, crude	lb.	.26-.27
Carnauba, refined, bags	lb.	.59-.71
Montan, bags	lb.	.25-.30
Spermaceti, blocks	lb.	.24-.27
Whiting, Bolted	lb.	.025-.06
Xylene (Xylol), drums, works	gal.	.32
Zinc, carbonate, bbls.	lb.	.14-.17
Cyanide, 100 lb. kegs	lb.	.33
Chloride, granular, drums	lb.	.06
Sulphate, crystals, bbls.	lb.	.04

*Subject to fluctuations in metal prices.

Getting Salesmen's Co-operation

Tying in Advertising with Selling

Getting out into the field

Copy Testing

DIRECT MAIL

Layout, Copy and Illustration

Market Information

contributing to the solution of general company problems

Readership of Publications

Measuring Results

ALLOCATION OF BUDGETS

Programs that management will approve

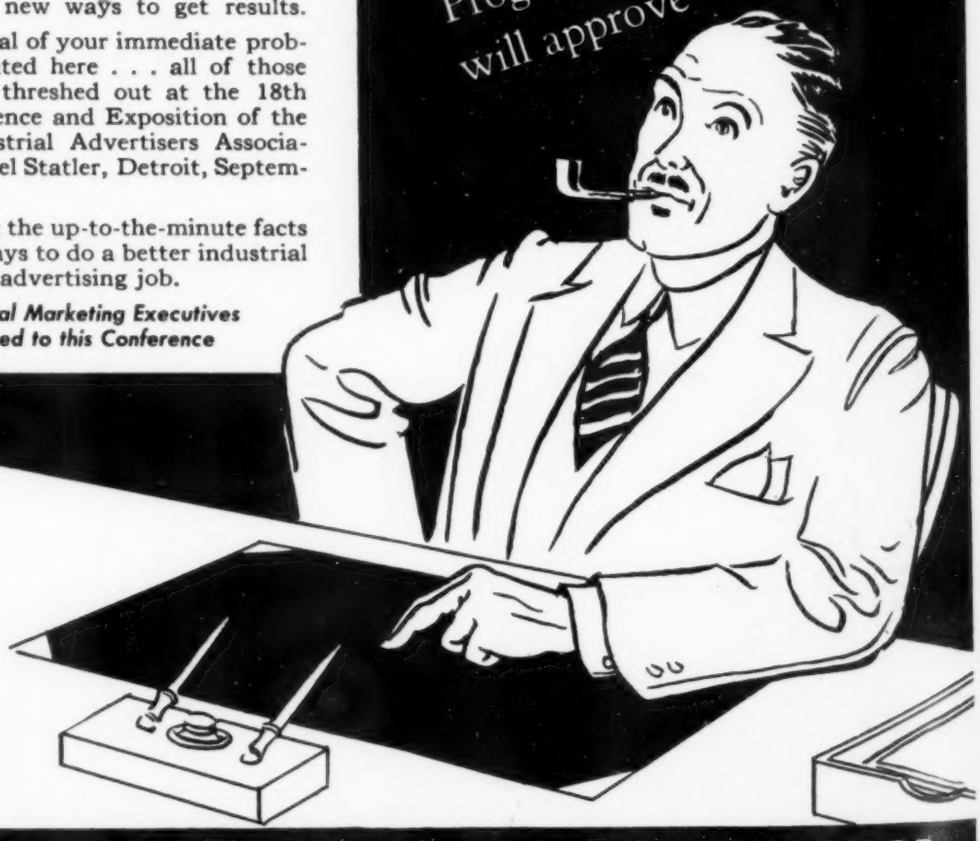
WHAT'S YOUR PROBLEM?

Your business . . . in at least one respect . . . is no different from others: *Your marketing problems are constantly changing.* You must ever be on the search for new ideas . . . for new ways to get results.

No doubt several of your immediate problems are indicated here . . . all of those shown will be threshed out at the 18th Annual Conference and Exposition of the National Industrial Advertisers Association, at the Hotel Statler, Detroit, September 18, 19, 20.

Plan now to get the up-to-the-minute facts on the latest ways to do a better industrial marketing and advertising job.

All Industrial Marketing Executives are Invited to this Conference



NIAA
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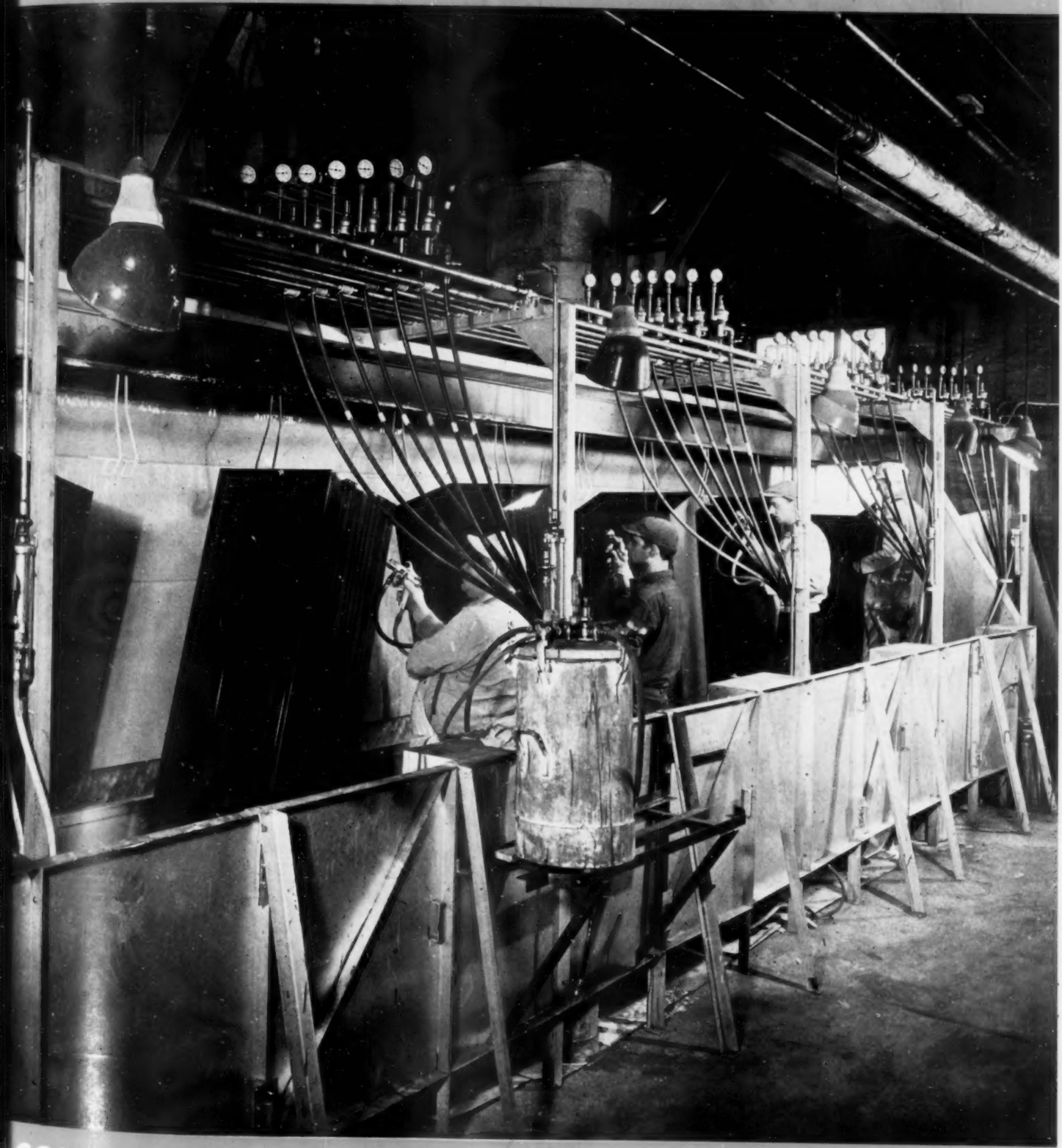
1940 INDUSTRIAL ADVERTISING CONFERENCE

DETROIT . . . HOTEL STATLER . . . SEPTEMBER 18, 19, 20

JUNE, 1940

ORGANIC FINISHING

SECTION OF METAL FINISHING



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duranite *Today's Finish For Today's Products*

A REVEALING TEST

Burn Resistant

DURANITE

Zapon's new, clear, "Burn-Resistant" Duranite S-413 gives remarkable heat resistance without loss of other qualities.

S-413 is water white in color. It has excellent adhesion, high resistance to abrasion and inhibits spotting out. S-413 may be baked 15 to 20 minutes at 275° F. and is used on brass, bronze, copper and other metals. Here's another Zapon number well worth looking into.

Why not write for a finished panel and try it out yourself? Apply a lighted match to the coated side of the panel until the match burns out. Allow the panel to cool. Wipe off soot and examine.

DURANITE—Trade Mark

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ATLAS POWDER COMPANY
Stamford, Conn.

ZAPON
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WESTERN SALES:
ZAPON-BREVOLITE DIVISION
ATLAS POWDER COMPANY
North Chicago, Ill.

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Section of
METAL FINISHING
Founded January, 1903

Publication Office
116 John Street, New York

ORGANIC FINISHING

SECTION OF METAL FINISHING

JUNE, 1940

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Blushing of Lacquers

The start of hot, humid weather within the next few weeks, has for many years been attendant with "blushing" or "blooming" of nitrocellulose lacquers. This phenomenon is caused primarily by the cooling effect engendered by the evaporation of the solvents used, resulting in the surface film temperature dropping below the dew-point of the surrounding atmosphere. The chilling, therefore, results in a precipitation of moisture on the surface of the work and finally this moisture precipitates either nitrocellulose or resin from the film.

Films that have blushed during drying possess, therefore, poor mechanical properties and are not fit for use.

Obviously, a complete cure of blushing troubles can be effected by air conditioning the room in which the lacquering is done. However, this is usually not economically practical and other means are employed to overcome blushing troubles. These include the use of retarders which are solvents for nitrocellulose and resins, which have sufficiently low evaporating rates to remain in the film after the temperature has risen above the dew-point and the moisture has left the surface and which may bring about a re-solution of the nitrocellulose film. In some cases, they may be used to retard the rate of evaporation so that cooling below the dew-point does not occur. The use of retarders with clear lacquers for coating brass or oxidized finishes may result in staining of the work and other means must be employed to obtain proper work.

Other means for overcoming blushing are: warming of the work before finishing, letting the work dry in its own atmosphere or warming the work after lacquering.

The availability of better solvents, new resins and in many cases, non-nitrocellulose finishing materials, is leading to a gradual disappearance of this age-old grief of the finishing room.

L. J. LANGDON, *Publisher* • THOMAS A. TRUMBOUR, *Business Manager* • DR. WALTER R. MEYER, *Editor*

New Conception of Petroleum Solvents and Thinners*

By Edward M. Toby, Jr.

American Mineral Spirits Company

A very interesting and timely article discussing the work of the petroleum industry in making new solvents for organic finishing materials. Methods for producing solvents, solvency evaluation, drying time tests, corrosion tests, odorless thinners, and coal tar substitutes are discussed.—Ed.

It is the primary function of an organization engaged in the manufacture and sale of technical products, or even of an entire industry engaged in kindred work, to keep abreast of the advances in those fields served by them and to attempt to develop their products along with developments in the industry they serve. They should also follow advances in their own field, so they can interpret these advances in the development of new, lower-cost, and superior products for their consuming trade. This is particularly applicable to us in the petroleum industry in our dealings with your own industry. Our common frontier is small indeed compared to our industry as a whole; and, unless we pay particular attention, developments in our industry might never come to your attention.

It is my opinion that the petroleum industry, insofar as the manufacture of solvents and thinners is concerned, has reached a crossroads on the path to ultimate perfection, and that we who are engaged in that industry must give care, study, and consideration to the choice of the proper course to be followed.

The petroleum industry is now in the middle of the process of metamorphosis. This industry was formerly primarily concerned in taking a barrel of crude oil and refining therefrom, by purely physical means, only those products which were useful for propulsion, illumination, lubrication, and for transfer into heat energy. Today the picture is changing, and changing rapidly. Today the refiner is interested in the transformation, by methods both chemical and physical, of that same crude oil into products that are suitable, from a chemical and physical standpoint, for use in many more diverse fields than those in which the products of petroleum could formerly be employed. In other words, the petroleum industry is not interested in petroleum as furnished by Nature, but it is more and more interested in the conversion of natural petroleum into definite synthetic organic chemicals by means of molecular rearrangements.

Petroleum Is Complex

Petroleum, or crude oil, as it comes from the ground is fundamentally a highly complex homogeneous mixture of hydrocarbons of different groups, the constituents of each group ranging over a wide range of boiling points. These hydrocarbons are primarily of the paraffin, naphthene (closed saturated cyclic hydrocarbons), and aromatic series, the geographical source of the petroleum largely being instrumental in determining the percentage of each group present.

Refining procedure called for the separation of these hydrocarbons into different boiling fractions by simple distillation. The first fractions were, by necessity, very wide, such as gasoline and kerosene, but these fractions were narrowed to close limits in order to furnish industry with close-boiling fractions, such as thinners, diluents, extraction and cleaning solvents, etc. In answer to a demand from the automotive field for more gasoline per barrel of crude, the process of cracking (thermal decomposition) was developed, and this process marked the first attempt to meddle with the petroleum molecules and convert them into other products. At first, cracking was intended only to increase the gasoline yield, but it was later noted that in this process the changes in the product undergoing cracking resulted in the manufacture of not only more, but a better motor fuel from a detonation standpoint.

You have doubtless read in the newspapers and in your trade journals of new refining processes that will change the whole story of petroleum refining. Today, these processes, used or contemplated, are many and varied, but the principal conversion processes can be classified as follows (among many other processes too numerous and complicated to mention):—

Hydrogenation	Catalytic cracking
Dehydrogenation	
Polymerization	Hydropolymerization
Alkylation	
Isomerization	Depolyalkylation
Aromatization	
Cyclization	Solvent extraction

Some of the processes used are catalytic, and some are noncatalytic, but all have the same common end—the rearrangement of the petroleum molecule into some other type of molecular structure more in keeping with modern demands.

Hydrogenation

Hydrogenation is, as its name implies, the addition of hydrogen to the hydrocarbon molecule at the points of unsaturation. Following intensive cracking, a finished product can about be made to order. Some petroleum thinners of high solvency values were so prepared, but this was discontinued

*Paper read February 23, 1940, before the Southern States Federation Associates in Atlanta. Reprinted from "Oil, Paint and Drug Reporter," March 1940.

due to instability of the finished product. This process is catalytic.

Dehydrogenation

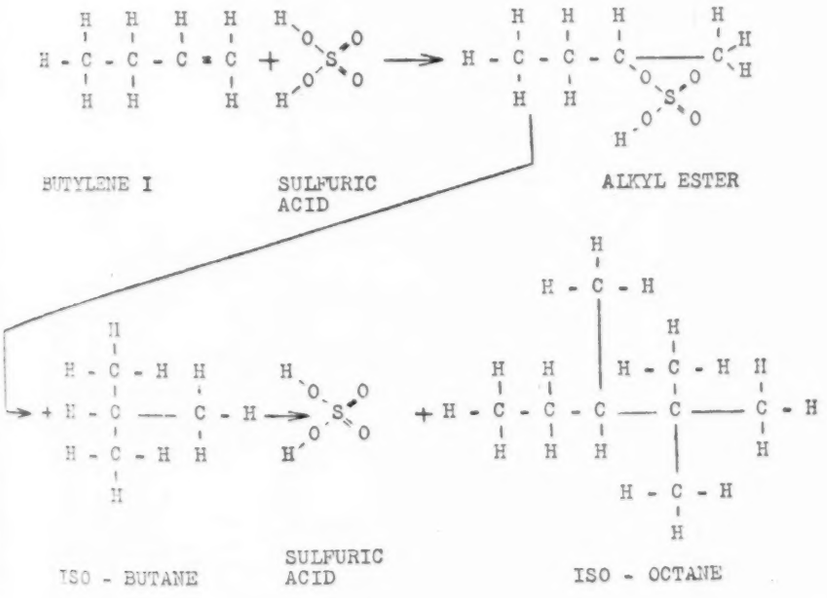
This is the removal of hydrogen from the molecule and is accomplished by shortening of the carbon chain or not, dependent upon conditions. This process can be either catalytic or non-catalytic.

Polymerization

This process involves the building up of small molecules into larger ones, the smaller ones in commercial use being the paraffinic and olefinic hydrocarbons up to and including butane, butylene, and butadiene. This process, both catalytic and thermal, produces higher boiling hydrocarbons. Some variations of this process give practically pure aromatic hydrocarbons that will some day find a place in your industry as well as a base for more involved organic synthesis.

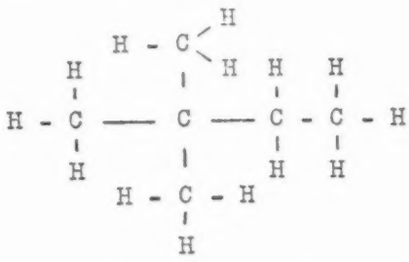
Alkylation

Alkylation is of utmost importance to us from military standpoints today, as it is the process by which isooctane, the base of super-aviation fuels, is prepared. Such [1]alkylation is done in the presence of sulphuric acid, and the simple mechanics thereof are as follows:—



The above reaction is being taken advantage of today, and many such plants are now under installation.

Alkylation can also be thermal, and one such process is now being used to manufacture neohexane—an isomer of hexane that has come in for much consideration lately because of its extremely high antiknock characteristics.



Solvent Extraction

This process is of the utmost importance to your industry in that it is the source of your high-solvency naphthas as today commercially procurable. In the strictest sense of the word, this process is not a conversion process, but a purification or isolation process. Many solvent processes now being used to improve the quality of lubricating oils depend upon the selective solvency characteristics of the solvents employed. In light-oil refining, extraction with sulphur dioxide is employed. Sulphur dioxide exerts preferential solubility for aromatic hydrocarbons when the extraction is carried on at low temperature. In essence, during commercial practice a long distillate is treated with sulphur dioxide at low temperature (approximately 60° F.) and the sulphur dioxide is then removed from the raffinate. The remaining extract is then fractionated into the desired boiling ranges, and you have your high-solvent naphthas. This process has its disadvantages, namely:—

1. The process is dependent upon the segregation of a crude, the distillate of which boiling between 100° and 400° F. is rich in natural aromatic hydrocarbons. Such crudes are scarce; segregation of crudes is always difficult; and these crudes are often found at points which make their commercial utilization difficult. This process of extraction will take distillate containing from 18 per cent to 35 per cent of aromatics and yield finished solvents containing 50 per cent to 90 per cent.

2. This process, because of the low temperatures necessary for successful operation, is both costly to install and to operate.

The other processes are also of great importance, both at the present and potentially, but lack of time prevents my discussing them in detail.

These conversion processes are part of the petroleum industry as a whole and are designed primarily to facilitate the manufacture of bulk products and not the specials required in your specific field of endeavor. However, in conjunction with these conversion processes it has been found that many products needed by your industry can be prepared synthetically, resulting in many cases in the manufacture of products of greater purity at costs far below prevailing levels. Alcohols, esters, fatty acids, ethers, ketones, aromatic hydrocarbons, glycerin, synthetic rubber, resins, etc., can now be manufactured from petroleum, and products so manufactured may replace to a large extent those products now being manufactured by the older processes.

Ethyl, isopropyl, butyl, and the higher alcohols are produced from the olefinic content of cracking gas, these products often being used as the starting point in the manufacture of other materials, such as acetone and dimethyl ketone. Some glycols are prepared from their corresponding olefins and are also by-products of ethylene-chlorhydrin and may be produced directly by the chlorination of ethylene. One of the most important products manufactured synthetically from petroleum recently has been glycerin, this being manufactured from crack-

[1] S. H. McAllister:—"High Octane Aviation Fuel by the Sulphuric Acid Alkylation Process" (The Refiner, November, 1939).

ing still gases. The olefins from cracking-still gases are chlorinated, substitution taking place, resulting in an allyl chloride. This allyl chloride may be chlorinated to 1:2:3-trichloropropane, or chlorhydrinated to dichlorhydrin, or hydrolyzed to allyl alcohol and then chlorhydrinated to glycerin monochlorhydrin. The trichloropropane and the chlorhydrins are then hydrolyzed to [2]glycerin.

The molecular rearrangements necessary to make such products are becoming more and more understood, and petroleum is becoming more and more to be considered as a base for organic synthesis, and it is not out of the realms of probability that its use for such purposes will some day supersede its use as a fuel oil.

Those of you in the lacquer manufacturing end have profited most from petroleum synthesis. The petroleum industry can prepare countless cellulose ester solvents and their use in lacquer formulation is increasing greatly.

What Road to Take

Therefore, the petroleum industry in striving to reach perfection in servicing your industry has reached a very definite crossroads. Shall the industry plunge into the new fields of conversion and attempt to develop synthetic organic chemicals that have utilization in your field, and neglect all proper research and development work designed to forward the perfection and use of those paraffinic hydrocarbon thinners now being used in the industry—or shall they stick to the narrow confines of the petroleum thinners now being used and neglect the golden opportunity to develop the new products offered by conversion or what has been so aptly termed [3]"Petroleum-ization"?

We will do neither. We will follow both roads so that your industry will derive the optimum advantages from petroleum developments. It is our intention to follow these new processes and to avail ourselves of those products which we might feel from experience have a definite place in your industry. These products will be offered you from time to time after the methods of manufacturing and the products themselves have proved acceptable from all points of view, including the economic. Your industry will see with the next decade a gradual influx of synthetic petroleum organic chemicals that will replace many such products manufactured by other methods today.

Let us now analyze the position of the petroleum industry to your industry insofar as the regular thinners are concerned. Such thinners are available to the trade today in almost any boiling range and in almost any degree of purity. We have made available to you commercially, solvents having boiling ranges of as low as 15° F., and we have purified such thinners so that we can supply them to meet the most rigid corrosion and sulphur specifications that you can devise. We can supply solvents possessing a solvency for resins and nitrocellulose bordering on the solvency of the coaltar or aromatic solvents themselves. What more can we do for you to keep abreast of the demands of your industry for such products?

It is my opinion that the greatest problem between our two industries is that of coordination, or rather, of evaluation and definition. We often speak in different languages, and this often leads to confusion and misunderstanding. We should cooperate on the following problems:—

1. The establishment of a suitable test for solvency that will evaluate a solvent in terms that will be of practical use to the formulator.

(Concluded in July issue)

[2] Gustav Egloff:—"Cracking Art in 1938."
[3] Hugh W. Field:—"Petroleum-ization—1940" (The Refiner, November, 1939).

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That Save Costly Production Dollars

The development and perfection of these Paasche Airbrush Units has been made possible by thirty-six years of pioneering progress . . . through research and practice . . . of an organization always daring to do what was considered impossible of accomplishment.

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Care of Brushes

By J. G. Shelton

This is a practical paper giving hints on the proper use, cleaning and storage of brushes.

The last few decades have seen a remarkable development in mechanical and semi-mechanical methods of applying organic finishing materials. Spray guns and automatic spraying machines, roller coaters, dipping machines, centrifugal machines and other devices have been greatly perfected and are being widely used. It is unquestionably true that such devices allow mass production. Where volume finishing must be accomplished, it is essential that they be used. However, there are and probably always will be, considerable quantities of finishing materials applied by brush. This holds for industrial as well as architectural applications, especially where advantage cannot be taken of the mechanical methods, either for reasons of cost or because the equipment does not successfully lend itself to the particular type of work.

The author feels that any knowledge of organic finishing is incomplete without some information or actual experience with brushes and brushing.

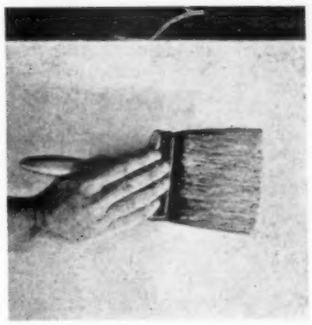

Fig. 2. The correct brush position.

It is the purpose of this article, therefore, to review some of the facts pertaining to this highly interesting subject, with special emphasis on the selection, use and care of brushes for applying paints, lacquers, enamels and other organic finishing materials.

Use of Brushes

The first point to consider is the selection of the proper size and type of brush, both from the standpoint of the kind of material to be applied and the surface to be finished. Some materials, such as varnishes, must be flowed on, in contrast with those which are brushed in or worked. In the latter class are the oil base paints. Flowing requires heavy bristles, with large carrying capacity in order that the surface be covered quickly and smoothly. For large areas a large brush must be used. Smaller areas call for proportionally smaller sizes. For grooves and recesses and where a sharp line must be met, the brush should have a sharp chisel, that is, it should be tapered to a thin edge.

When a brush is first used, it may shed a few bristles. To remove these before work is begun, shake the brush vigorously and, after dipping in the material, draw it across a rough surface a few times. If the brush is of good quality and if it is not abused in handling or cleaning, no more bristles should fall out after this treatment.

Fig. 1. For small sections the narrow brush is required.

Fig. 3. Proper cleaning requires complete removal of material from bristles.

Fig. 4. Misused brush showing rounded ends and flared and fishtailed bristles.

Fig. 5. A dull blade is used to remove accumulations of material from the binding.

Brushes should be held lightly and easily in the hand, in a position similar to that of a pencil, with the bristles making a forty-five degree angle with the surface. Round brushes as well as flat types must never be stroked edgewise. To do so will round over the ends of the brush. Wide brushes used on narrow surfaces will show wear on the center bristles and produce fishtailing. In order that the shape of the brush not be destroyed, it should be turned over occasionally so that both sides wear evenly. Dipping the brush too deeply in the finishing material, bearing down too hard and painting overhead surfaces for long periods will cause a brush to leak. If leaking occurs, the brush must be squeezed out to remove the excess material. Where it is possible, a brush should not be used with more than one type or color of finishing material.

Care of Brushes

To obtain the long and satisfactory service which any good brush is capable of giving, it is necessary that care be exercised in cleaning and storage. With respect to cleaning, one of the most important points is that the brush be cleaned immediately after use, regardless of the time which is to elapse before it is employed again. Not only is it easier to remove fresh paint, but old dried paint will cause a brush to flare and mat and consequently quickly ruin the brush for clean, smooth and efficient painting.

The best cleaner for a brush depends on the kind of material which is to be removed from the bristles. For oil or varnish base paints, turpentine is one of the best cleaners. Petroleum spirits, white gasoline (ethyl gasoline should be avoided) and kerosene may also be used. Lacquers require lacquer thinner. In some cases where thinner is not available, acetone or a mixture of acetone and alcohol is effective as a lacquer cleaner. Shellac is removed with alcohol. Brushes used with cold water paints, calcimine, whitewash and similar water vehicle materials should be cleaned with warm water, followed by a rinse of warm water to which a small amount of vinegar has been added. A good rule to follow in cleaning any brush is to use the thinner recommended for the finishing material. In addition to various thinners there are a number of commercial brush cleaners on the market which are inexpensive and effective.

One type of cleaner is an emulsifiable solvent which is a solvent for the finishing material and which can be rinsed off with water.

When cleaning brushes, it is essential that a sufficient amount of thinner be used to remove all of the material from the bristles. However, all the thinner should not be used at once. Work the dirty brush in a small quantity of thinner, using the fingers if necessary. Remove as much liquid as possible by squeezing and then gently bat the bristles against a board. Repeat this operation until the thinner shows that the material has been completely removed. If there is an accumulation of material near the binding it may be removed with a dull blade, taking care, however, that the bristles are not cut.

Storage

After cleaning and in preparation for storage, the brush should be smoothed into shape and then carefully wrapped in paper to keep the bristles flat and smooth. Ordinary heavy wrapping paper may be used. There are also paper containers made specifically for the purpose. For brushes used in applying oil base paints, linseed oil is worked into the bristles before wrapping and then the brush is suspended in a can of the same oil. Brushes should always be hung by the handle during storage and never laid flat or in such a position as to bend the bristles. New brushes, or those which are stored dry should be kept in a cool place which is free from moisture. Moth repellent should be used where there is danger of the bristles being attacked.

Fig. 6. Praper-wrapped brush ready for storage.

A well made brush is a fine tool and must be treated as such. Intelligent selection plus careful use means brush economy and satisfactory brush finishing.

(Photographs courtesy of Wooster Brush Co. and American Paint Journal.)

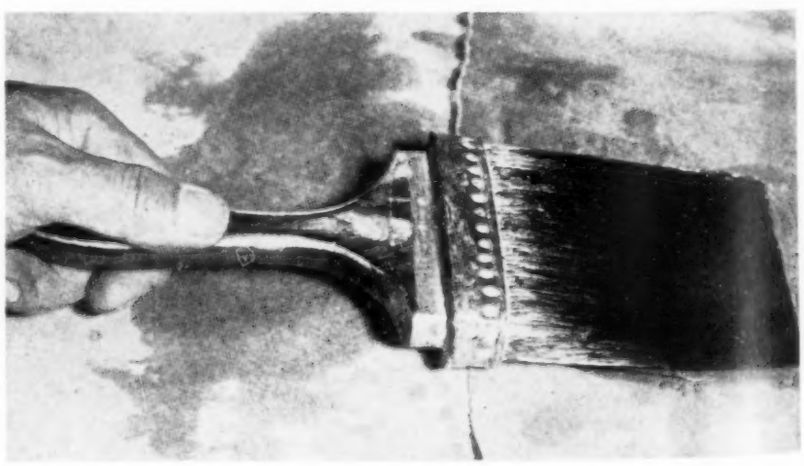

Fig. 7. A well-cared for brush showing uniform and compact bristles.

Finishing System at Allis-Chalmers

By F. R. Anderson

Detroit, Michigan

The finishing system, installed at the Allis-Chalmers plant, Pittsburgh, includes complete equipment for cleaning, rust-proofing, drying, painting and baking operations in the production of transformer containers, which range in size from 31″ dia. x 38″ deep to 41″ dia. x 44″ deep. The entire system was engineered and coordinated by The R. C. Mahon Company, Detroit, Mich., to meet the manufacturer's specific requirements in the application of two coats of synthetic enamel in the finishing process.

The transformer containers are carried through the system, on a monorail conveyor, suspended in an inverted position. They pass through washing, rinsing and rust-proofing stages of the system, then through a direct gas-fired drying oven into a "hydro-filter" spray booth where the first coat is sprayed by hand. The product is then carried into and through a baking oven where the first coat is baked at a temperature of 350°F. The conveyor then carries the product out of the oven, through a cooling zone, and into a second "hydro-filter" spray booth, where the second or final coat is applied, and thence into the baking oven where the final coat is baked at a temperature of 350°.

The conveyor then carries the product to the unloading zone which is adjacent to the loading area. The washing and rinsing stages are heated by means of immersion type gas heaters in which the gas is burned in tubes submerged in the solution in the tanks, the rust-proofing section being heated by a direct-fired gas heating system in which the gas is burned directly in the processing chamber. This method of heating eliminates considerable build up of scale on the heating equipment, and also provides better conditions for rust-proofing in the processing chamber, due to the fact that a large percentage of the oxygen is burned from the atmosphere in the process stage, and, processing is accomplished in partially reduced atmosphere. The gas burners on all of these tank heating units are fitted with complete safety and temperature control systems. The safety control units are designed to automatically cut off the main gas valves in case the pilot lights are extinguished, or when electric current fails or gas pressure drops below a predetermined point. The temperature control units are designed to maintain an operating temperature in the tanks of approximately 180°F. Gas burners are designed to operate on a high-low operation.

At the exit end of the washing, rust-proofing and rinse units, an automatic blow-off is provided to remove entrained water held in the bottom of the inverted transformer containers. This is a very necessary operation to insure the removal of all excess water before entering the dry-off oven. In this installation the blow-off air is taken from the blower that supplies combustion air for all of the gas burning equipment.

The dry-off oven is heated by means of a direct-fired line burner mounted on the floor of the oven and designed to operate on high-low operation. It is fitted with complete safety and temperature controls to maintain an operating temperature of 350°.

The two "hydro-filter" spray booths are of the open top, down-draft type fitted with full flooding curtains so that the entire back of the booth is flooded with water. All over-spray or pigment is removed from the air in the centrifuge section of the hydro-filter chambers before it passes out through the exhaust fans.

The baking oven, for both first and second coats, is heated by means of a surface combustion direct gas-fired air heater designed to burn gas in the combustion chamber, and circulate the heated air and products of com-

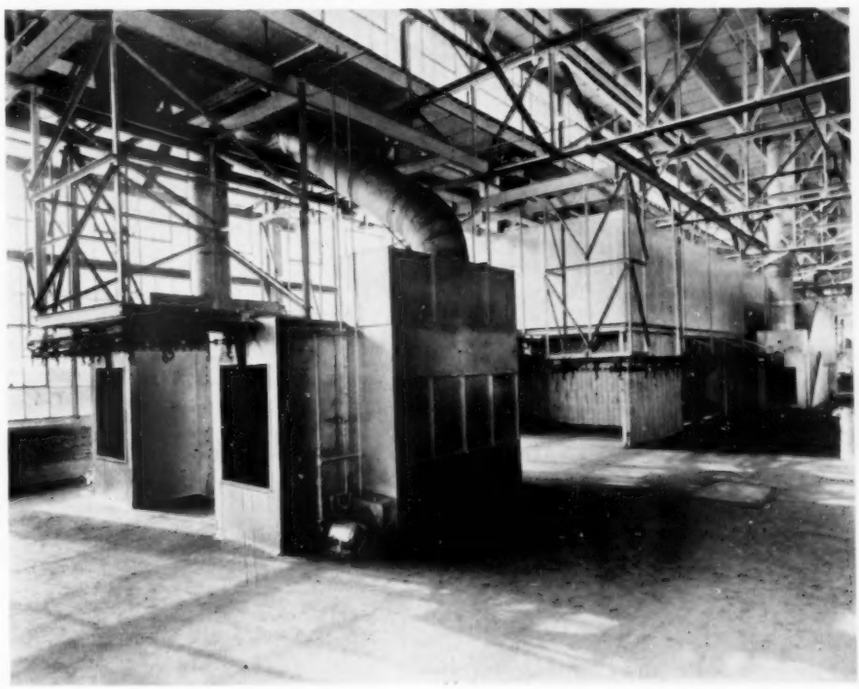

Fig. 1. General view of complete finishing system, showing spray booths in the foreground.
(Courtesy the R. C. Mahon Co., Detroit, Mich.)

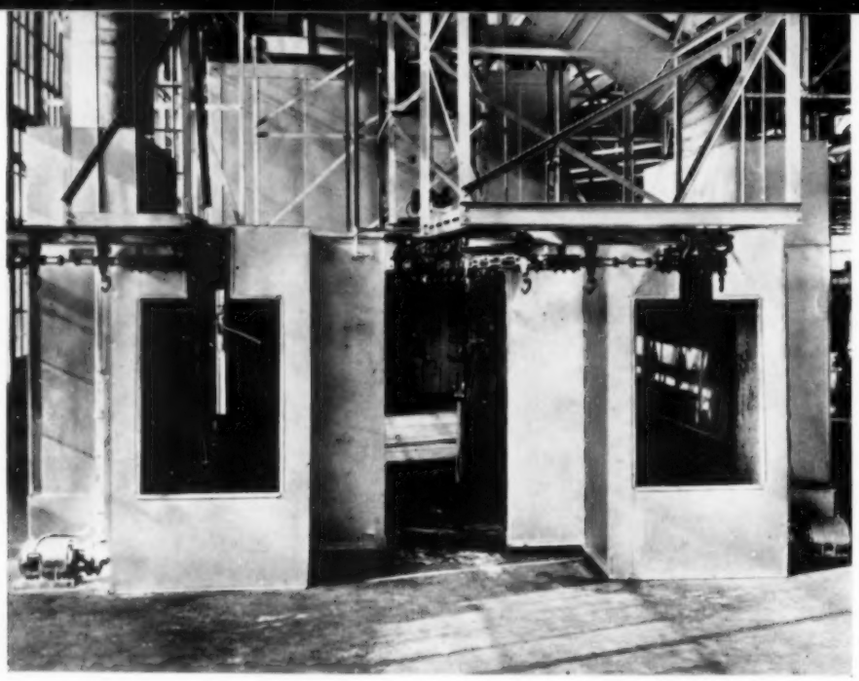

Fig. 2. Entrance end of first and second coat spray booths of the Mahon hydro-filter type.

bustion through the oven proper. This heater system is designed to recirculate a considerable amount of the air handled from the oven so as to retain the heat therein. The gas burner and blower equipment is installed on the floor directly below the raised oven and is equipped with complete safety and temperature control.

This finishing system was designed to do a specific job thoroughly and economically. At its normal conveyor speed of 3 ft. per minute, it handles fifty transformer containers per hour. The conveyor is equipped with a variable speed drive which permits a conveyor speed range of approximately 50% above and below normal operating speed.

✦ ✦

Spraying Equipment Finds Many Uses

Uses of spray equipment range all the way from the treatment of flour in the process of baking doughnuts, to the application of the finish on the giant type locomotives.

Perhaps one of the most unusual adaptions of the equipment is that by several cereal manufacturers. They infuse the cereals with a solution of vitamins through the medium of the spray equipment.

In another plant where cereals are prepared, the equipment is used for spraying a solution which causes the product to turn a beautiful brown when baked.

Then there is a grain concern, employing the equipment for spraying a disinfectant into freight cars to rid them of vermin before loading.

Pinocchio and Shirley Temple dolls, favorites of the juvenile world, receive their flesh tints through a Rotary Type Automatic Spray Painter, installed in a large toy factory.

Over in Jersey City, a toilet preparation concern uses the equipment for spraying perfume on soap.

Another use somewhat out of the ordinary, is found in the plant of a sporting goods manufacturer, who employs the equipment for applying varied colored stripes to the shafts of arrows included in archery outfits.

—Courtesy The DeVilbiss Co., Toledo, Ohio

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An ideal finish for products which are to be subjected to frequent handling since it is highly resistant to body acids.

Air dries in usual lacquer drying time but maximum resistance may be hastened by force drying.

May be used on brass, copper, bronze, oxidized copper, gunmetal, iron and steel, as well as polished copper, aluminum and nickel.

Produces a hard film, extremely durable to wear and tear.

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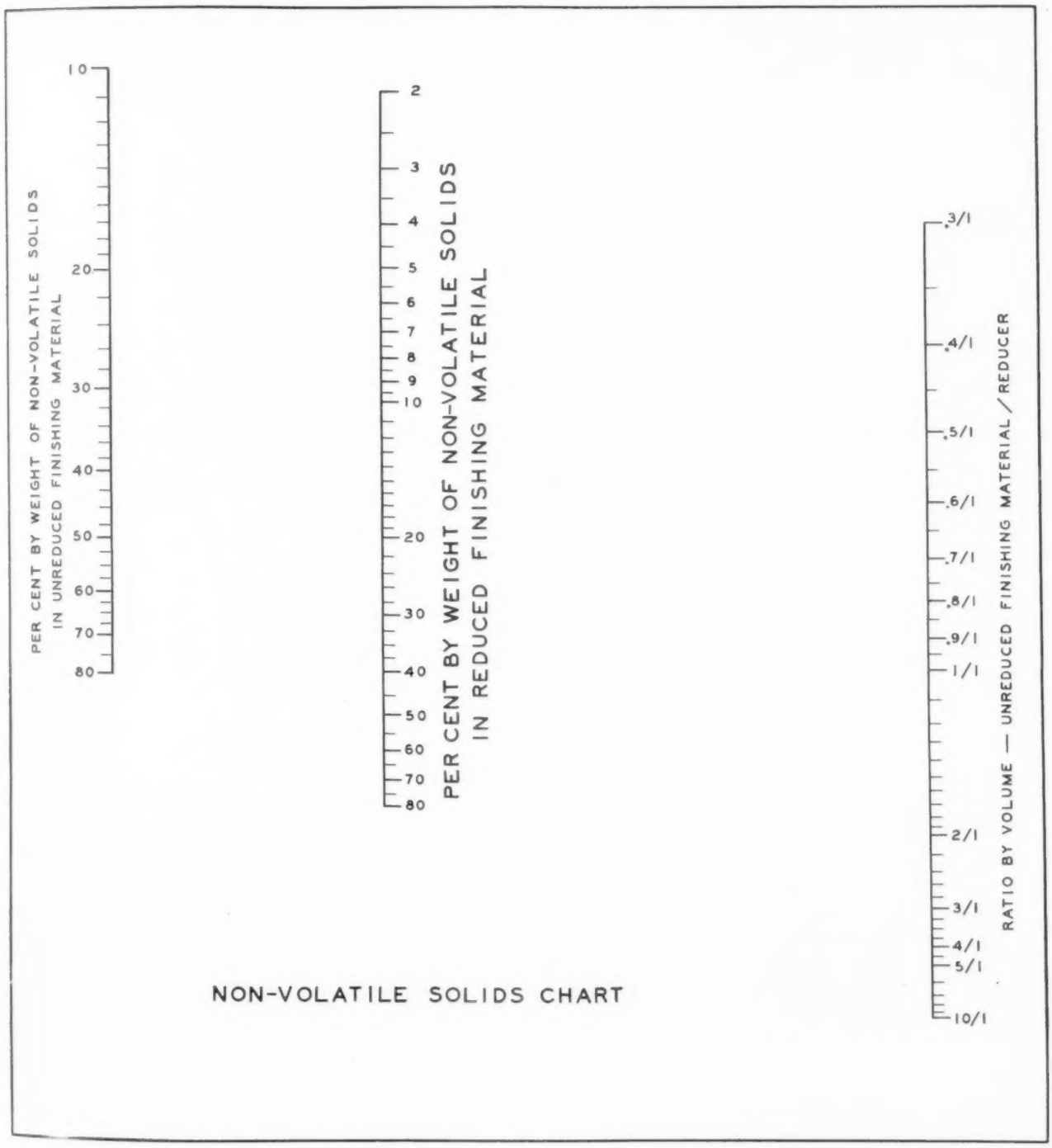
EGYPTIAN *Superior* FINISHES

Non-Volatile Solids Chart

In connection with the discussion on calculating the solids content of reduced organic finishing materials which appeared in the March issue of METAL INDUSTRY (Organic Finishing Section, pages 176-7) the author, Mr. W. G. Sheane, has prepared the following chart, based on brief equation No. 3. Eliminating the necessity for mathematical calculations, the chart provides a rapid graphical determination of solids content in reduced organic finishing materials. To obtain this datum, it is only necessary to connect with a straight line the value of the solids content of the unreduced material on the left hand scale and the value of the reduction ratio on the right hand scale. This line will intersect the center scale at the value of the solids content of the reduced material.



NON-VOLATILE SOLIDS CHART

ORGANIC FINISHING DIGEST

PATENT AND LITERATURE REVIEWS

PREVENTION OF DERMATITIS IN THE PAINT AND VARNISH INDUSTRY. H. Pfanner, Farben Chem. 10, 269-71 (1939). Workers in the paint, varnish and lacquer industries who are prone to dermatitis or skin conditions, particularly those who have idiosyncracies or allergies towards paints, etc., manifested by skin eruptions, can counteract this tendency by avoiding the use of alkaline cleansing agents such as soaps, when washing their hands and bodies. Instead the newer types of acidic cleansing agents should be used. These acid type agents clean without changing the natural condition of the derma. Alkaline cleansing agents render the skin susceptible to external influences.

DRYING OILS AND RESINS. T. H. Bradley & H. P. Pfann. Ind. & Eng. Chem. 32, May 1940, 694-697. A gelled product derived from the thermal treatment of 98% oiticica oil plus 11% sardine oil is found by the authors to contain 70% of polymerized glycerides, which are amorphous solids that cannot be dissolved in the common solvents, together with 30% of a soluble liquid phase of polymerized glycerides.

LINSEED OIL FILMS. H. F. Payne. Ind. & Eng. Chem. 32, May 1940, 737-743. The writer finds large differences in permeability, adsorption and solubility in films made from untreated linseed oil and films made from the oil after heat treatment. The increase of the time of heat treatment has relatively little effect on the film properties. The water adsorption of films made from high acid oils is greater than that of films made from low acid oils but the diffusion of moisture through high acid films is retarded by the metallic soaps formed so that the permeability to moisture is lower in the high acid oils.

PRODUCT SURFACE FINISHING. G. Klinkenstein. Mech. Eng. 62, 323-4, April 1940. A general discussion of the subject.

SOME ASPECTS OF FADING OF COLORED PIGMENTS. L. Mackenzie Richards. National Paint Bulletin, 4,12-15 Feb. 1940. The only really permanent pigmenting compounds are those whose color depends on iron oxides or silicates or chromium oxides. The power of the sun to fade pigments is proportional to its ability to effect the decomposition of silver halides.

DISPERSION OF PIGMENTS IN AQUEOUS MEDIUM. I. F. K. Daniel, India Rubber World 101, 50-2, #3 1939. The relationships between wetting, dispersing and protective agents and the mechanisms of their actions are discussed and well known methods for testing the degree of dispersion are described.

MANUFACTURE OF LITHOPONE. Industrial Chemist. 16, 72-7, 1940. A review of the modern methods of processing and patents on the manufacture of lithopone.

USE OF NON-DRYING AND SEMI-DRYING OILS IN THE PAINT AND LACQUER INDUSTRY. N. A. Suvorovskaya. Org. Chem. Ind. (U.S.S.R.) 6, 227-31 (1939). A number of receipts are given for the formulation of drying oils from cottonseed, corn, sunflower and meal oils and from glyptal resins combined with semi-drying oils and treated castor oils. The best results are obtained for cold drying with lacquers prepared from glyptal resins and castor oil at 280°. Glyptal resins with semi-drying oils give satisfactory films with hot drying as well. Oxydized and dehydrated semi-drying oils are well suited for black lacquers.

DEHYDRATED CASTOR OIL. P. W. Greubel. Am. Lac. Maker. 18, #2, 20-1 (1940). A general review of the chemistry of castor oil and the process of manufacture into the dehydrated product and the production of synthetic Tung oil.

SOLVENTS FOR NITROCELLULOSE. I. DETERMINATION OF THE RATE OF SOLUTION. A. Kraus. Farben Chem. 10, 236-7, 242, 301-4 (1939). The rate of solution of nitrocellulose in various organic solvents (22) is determined by the author by suspending a thin strip of nitrocellulose 5 mm. wide, 50 mm. long and 0.1 mm thick in the solvent to be tested so that it is suspended vertically with 10 mm. of the strip below the surface level of the solvent. The amount of time required for the exposed piece of nitrocellulose to break away from the main body of the strip is taken as a measure of the rate of solution. Tests with motion picture film base as well as with films of nitrocellulose with the same solvents gave the same order of relative rate of solution, with the 22 solvents belonging to the alcohol, ester or ketone class. His studies show that: (1) In mixtures of solvents and nonsolvents the different nonsolvents as a rule decrease the rate of solution to a different degree; and (2) for certain solvent-nonsolvent mixtures, the rate of solution may be increased by limited amounts of nonsolvents. The effect is not one that can be classed as a general one; i.e., it cannot be predicted that it will occur for a given combination of solvent and nonsolvent not previously tried. With highly polar solvents, e.g., ethyl lactate, addition of even hexane or octane (amt. 20%) increased the rate of solution of the mixture and decreased the viscosity of a 3.2% solution of nitrocellulose. Practical use of this phenomonon can be made by formulating lacquers having a minimum tendency to lift previously applied lacquer films.

PART II. INCREASED SOLVENT POWER DUE TO WATER. Farben Ztg. 44, 1031-2, 1052, (1939). The solution rate of nitrocellulose was increased by the addition of water (around 0.5-1% or saturation) to various organic solvents such as esters, ketones and glycol derivatives, and to a 40:60 alcohol ether solution. Such additions of limited amounts of water also decreased the viscosity and minimized the turbidity of solutions of nitrocellulose. With increasing amounts of water (10% in alcohol-ether solutions, containing 10% of nitrocellulose), the solutions tended towards turbidity and the original higher viscosities observed with the anhydrous solvents. Additions of small amounts of water to compounds such as formic acid or acetic acid, diminished their solvent power for nitrocellulose while with propionic and butyric acids, the rate of solution for nitrocellulose first increased (10% water) and then decreased (15%-25% water).

NEW ZINC RESINATES INCLUDING THEIR USE WITH TUNG OIL SUBSTITUTES. E. Edelstein. Paint Ind. Mag. 55, 90-2 (1940). Newer types of zinc resinates have a higher zinc content, higher melting points, lower acid numbers and paler colors than was previously possible. Zinc resinates have been successfully incorporated into oiticica oil varnishes. The zinc resinate apparently affects each paint and varnish in about the same manner, regardless of the oil or combination used. He draws the following conclusions: (1) Zinc resinates are an aid to drying particularly in conjunction with synthetic resins and ester gum; (2) They promote wetting and dispersion of the pigment; (3) They help improve the gloss and adhesion of the film; (4) They help to eliminate skinning and wrinkling; (5) They are excellent dispersing agents for oil gels and therefore make it possible to work drying oils in new ways; (6) When used with the usual dryer combinations they inhibit the loss of drying strength; (7) Owing to the relatively high melting points, they exert an immediate hardening effect which is followed by thorough drying due to the zinc.

NEW EQUIPMENT AND SUPPLIES

LATEST COMMERCIAL DEVELOPMENTS IN ORGANIC FINISHING

New Wood Stain

The Zapon Division of Atlas Powder Co., Stamford, Conn., have announced the development of "Zaponol", a new wood stain material, which is said to have sealing effects and controlled penetration, in addition to the usual properties of wood stains. The basis for the claimed unusual effectiveness of the stain is a new synthetic resin developed by the company.

The regular water soluble stain powders for colors are dissolved in the water solution of the new resin. An outstanding feature stated for the stain is the elimination of a wash coat for most work inasmuch as the stain is said to "size as it stains", resulting in controlled penetration of the surface fibers.

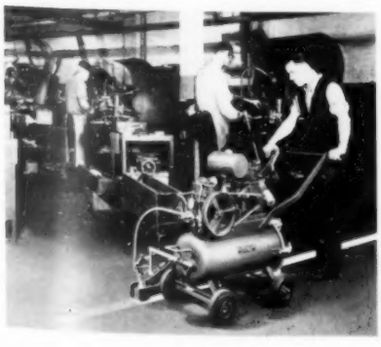
Zaponol is insoluble in the subsequent finishing materials. Easy surface conditioning and absence of tear-outs are claimed with the use of the stain. The stain may be readily applied by the usual methods and no new equipment or techniques are necessary. The base is a clear water-white liquid which is made available so that the desired stain colors can be added on the job.

The Zapon Division has prepared a brochure including sample wood panels, which will be sent upon written application to furniture manufacturers and others in the wood finishing field.

New Spray Line Marker

Binks Manufacturing Co., 3112 Carroll Ave., Chicago, Ill., have announced the production of their new spray line marker, which is stated to be a complete self-contained portable spray unit for the marking of traffic lines for highways, city streets, warehouses, airports, steel mills, large factories and wherever traffic lines are important.

The unit is claimed to be ideal for one-man operation and will lay down a stripe from 2" to 6" in width at the rate of one to four miles per hour, depending on the condition of pavement or floor. Equipped with a ¾ H.P. gasoline engine and four pneumatic tires, the unit is easy to handle. The operator has a clear view at all times of the old stripe or the guide lines laid down. A 12-gallon material pressure container is said to keep the spray gun supplied with material.



Spray Line Marker

Complete details and prices on this unit may be had by writing for information on No. 240 spray line marker.

Treatment for Galvanized Coatings

Neilson Chemical Co., Benson & Bellevue Sts., Detroit, Mich., are marketing a material called "Galvaprep", for treating zinc surfaces previous to painting, and other organic finishing.

The primary function of the material is to treat various zinc surfaces so that maximum enduring adhesion can be obtained between the organic finish and the zinc surface. A chemical reaction takes place between the Galvaprep chemicals and the zinc surface converting the surface into a hard inert, etched surface receptive for the coating. The solution is said also to remove or neutralize corrosive agents that may be harmful to the paint.

The material is diluted with an equal volume of water and the parts may be either immersed in the solution or brushed with it. A one-minute dipping time is recommended, and after rinsing off solution in hot or cold water, the work is allowed to dry and then it is ready for the finishing.

Process for Treating Aluminum and Its Alloys

Colonial Alloys Co., Philadelphia, Pa., have announced a low cost, non-electrolytic method of producing a hard, smooth and tenacious coating on aluminum, which is said to be ideally receptive to organic finishes.

The coating is stated to be corrosion resistant, colorless and integrally fused with the base metal. The "Chemodizing" solution, as it is called, is furnished ready for the operator to mix with water. The process is substantially a simple immersion one, and the use of heat is optional. The immersion time is not critical and may range from 5 minutes to 20 hours.

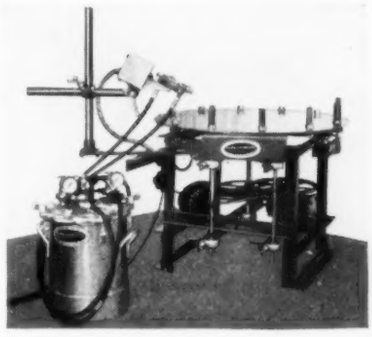
The usual degreasing and cleaning necessary in most metal protection processes can be omitted. The solution is claimed to be non-toxic and without objectionable odor and is stable when not in use. Being an immersion process, the throwing power of the solution is dependent only upon access of the solution, and thus complicated shapes can be coated as uniformly as simple shapes.

The process is recommended for cases where aluminum alloys must withstand the action of high humidity, corrosive atmospheres and marine atmospheres.

Further information can be secured by inquiring of the Chemicals Division of the company.

Automatic Tube Sprayer

The Eclipse Air Brush Company, 396 Park Avenue, Newark, N. J. has built an automatic sprayer to coat the inside and outside of steel tubes, 4" long, with an inside diameter of 1".



Automatic Tube Sprayer

The tubes are placed in an upright position on an automatic turntable which rotates them as they pass in front of a solenoid operated spray gun, synchronized with the action of the turntable.

A treadle operated spray gun coats the insides of the tubes as they are set into a holder on a stationary table. The setting and removing of the tubes for both inside and outside coatings are manual operations.

Production on this work is 1200 per hour for the outside, and the same for the inside.

Low Priced Spray Booth

A small inexpensive spray booth has been announced by Binks Manufacturing Co., 3114-40 Carroll Ave., Chicago, Ill.

The booths are sold in one standard size only, width, height and depth being 3′ 6″ each. All panels are interchangeable so that the exhaust fan can be run out of top, side or back of booth as desired. A new line of inexpensive 15″ diameter exhaust fans has been designed to be used with the new booths.

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Conveyorized Immersion Degreaser Used On Heavy Stampings.

THE modern camera — precision built and attractively finished — requires cleaning at many points of its production. In this respect Detrex Solvent Degreasing aids manufacturers throughout the country . . . cleaning their metal products for better finishing and finer performance . . . giving them greater sales appeal!

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IN CANADA: CANADIAN HANSON & VAN-WINKLE CO., LTD., TORONTO, ONTARIO

The booth can be purchased complete with 31" legs, or less legs. Full details as to construction and prices of all accessories may be had by writing to the manufacturer.

Manufacturers' Literature

Black Finish. The Forbes Varnish Co., Cleveland, Ohio, in a calendar bulletin, describe their prime finish black No. 2, which is stated to be a low-priced pyroxylin lacquer adaptable to finishing of gear cases, switch boxes, interior of cabinets, etc., wherever a low-cost black finish is desired. It is used primarily as a one-coat finish on metal and can be supplied to take 100% reduction or more.

Industrial Ovens. A new 24-page book describing industrial ovens has just been issued by Kirk & Blum Mfg. Co., 2859 Spring Grove Ave., Cincinnati, Ohio. It illustrates and describes a number of specially designed and engineered gas-fired and electric industrial ovens, and contains information for executives interested in faster and more economical drying, baking and enameling operations. A copy will be mailed upon application to the manufacturers.

Polymerin. A new handbook on "The Facts on Polymerin" is being distributed by Ault & Wiborg Corp., 75 Varick St., New York City, which describes how this material is used for industrial finishing. Photographs of some of the productions that have proved to be suited to this type of speed finishing operation are shown. The book also describes the characteristics of Polymerin finishes including both high bake and low bake material, and Polymeroid, a hammered-effect finish for rough and porous metal surfaces. Illustrations of various finishing operations are also given.

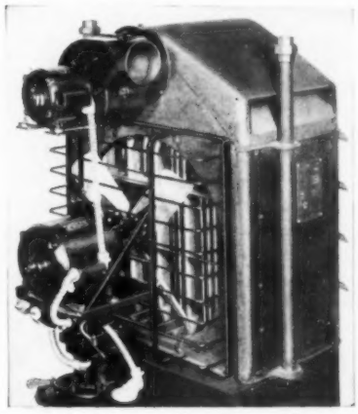
Sanders. Porter-Cable Machine Co., 1714 N. Salina St., Syracuse, N. Y., in a recent folder describes portable sanding equipment. The sanders described are of the belt, disc and spindle types.

All Purpose Fan

Autovent Fan & Blower Co., Chicago, Ill., announce their newly perfected "Allvent", all-purpose ventilating fan that claims to provide any normal required amount of air changes without objectionable noises.

Features include "V" belt drive that makes possible slower, quieter operation and greater efficiency with 1750 R.P.M. stock motors than heretofore obtained with costlier, low speed special motors.

New design 3 blade fan wheel supplies or exhausts unusually large volumes of air at extremely low speeds, and large enough volumes of air are handled to do a comfort-cooling job as well.



All-Purpose Ventilating Fan

Plating and Finishing Guidebook

The 1940 Guidebook with a section on Organic Finishing has been mailed to all subscribers of Metal Finishing. Your subscription to Metal Finishing will bring you this valuable handbook.

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